135

ANNOTATED BIBLIOGRAPHY FOR AQUATIC RESOURCE MANAGEMENT OF THE UPPER COLORADO RIVER ECOSYSTEM

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ANNOTATED BIBLIOGRAPHY FOR AQUATIC RESOURCE MANAGEMENT OF THE UPPER COLORADO RIVER ECOSYSTEM

By
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Kim Gilbert
Karl Seethaler
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WASHINGTON, D.C. / 1980

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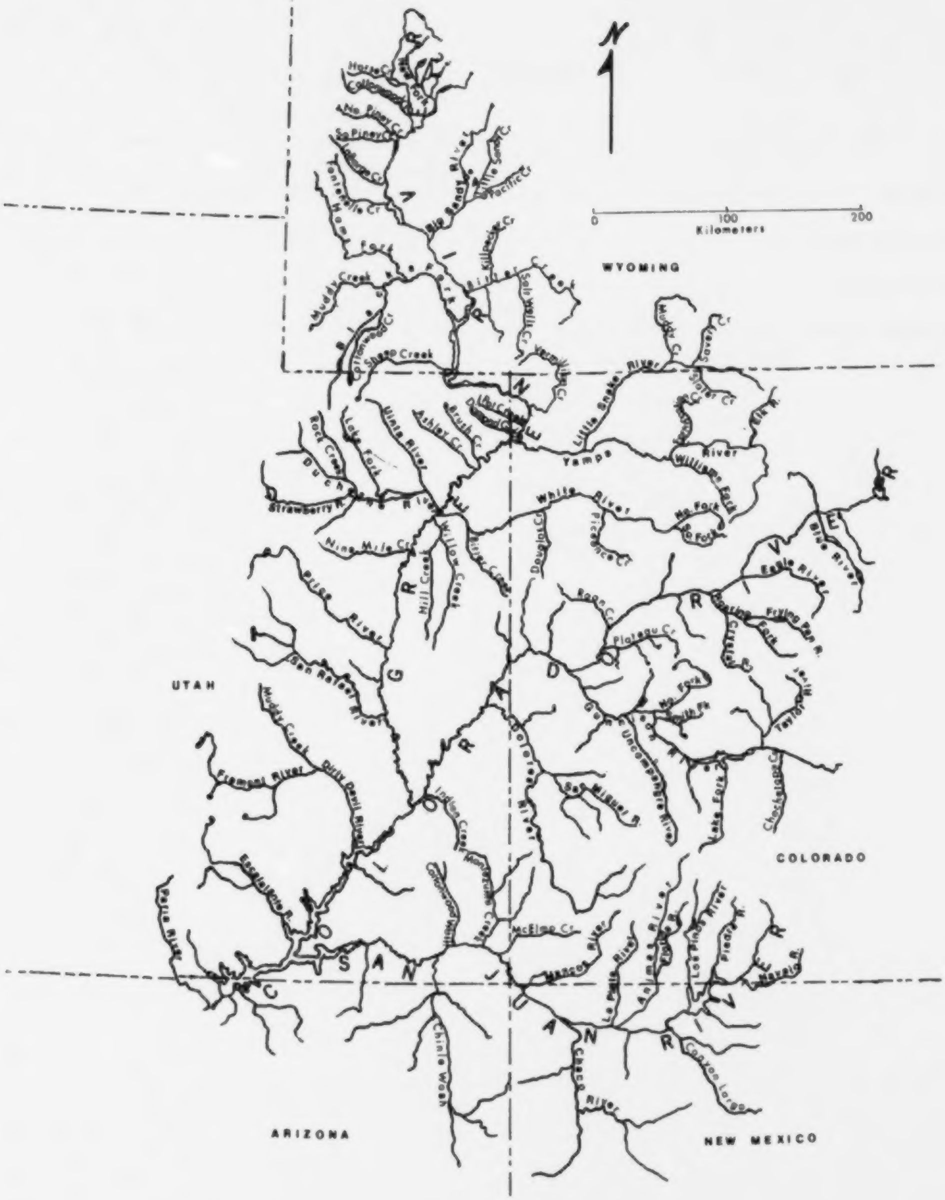
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UPPER COLORADO RIVER SYSTEM

ANNOTATED BIBLIOGRAPHY FOR AQUATIC RESOURCE MANAGEMENT OF THE UPPER COLORADO RIVER ECOSYSTEM

by

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ABSTRACT

The development of water and other natural resources in the Upper Colorado River Basin will continue to have an impact on the ecology of this unique ecosystem. Numerous water-development projects have been completed on the river, others are in progress, and still others are contemplated, to provide water necessary for municipalities, irrigated agriculture, and energy production. Four endemic fishes--Colorado squawfish (Ptychocheilus lucius), humpback chub (Gila cypha), bonytail (G. elegans), and razorback sucker (Xyrauchen texanus)--are considered rare and may be threatened with extinction if their ecological requirements are not considered in the total management of the Colorado River. Although much information is already available on this river, it is widely scattered in the published literature and unpublished reports of various state and federal agencies. This annotated bibliography contains 1,109 published or readily available unpublished references that should be useful in decisions regarding effective management of the Upper Colorado River Basin. Selected key words were assigned to all references and indexed for ease of locating references on particular subjects.

INTRODUCTION

The Colorado River flows through 2,317 km (1,440 miles) of land so arid that the basin produces only about 7.4 hectare-meters (60 acre-feet) of water per 2.6 km^2 (1 square mile)--less than that produced by any other major river in the United States (Utah Water Research Laboratory 1975). This river serves 15 million people by supplying water for cities, irrigated agriculture, energy production, industry, and mining. The urban population of the Colorado River Basin is expected to increase about 250% between 1960 and 2000, and to require a threefold increase in municipal water (Crawford and Peterson 1974). In addition, the development of some of the largest sources of natural energy fuels in the country will require a large quantity of water in the future.

The history and importance of the Colorado River Basin were described concisely by Crawford and Peterson (1974): "The Colorado is probably the most utilized, controlled and fought over river in the world. It flows through lands of incomparable beauty and includes nearly seven percent of the nation's contiguous land mass, including parts of seven states. From the time of the early settlers to the present, the water of the Colorado River has been the key to development of the arid region."

Numerous water-development projects have been completed in the Upper Colorado River Basin, others are in progress, and still others are contemplated. Although much information is available on this valuable river basin, it is widely scattered among various private institutions and federal and state agencies.

The original purpose of this annotated bibliography was to compile information on the distribution, relative abundance, and ecology of fish and macroinvertebrates in the Upper Colorado River Basin as a ready reference source for present and future studies. However, it soon became apparent to us that the addition of selected references from various fields such as archaeology, ecology, economics, geology, history, hydrology, and law, as well as other subjects, would greatly broaden

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[3] Cooperators include the U.S. Fish and Wildlife Service, Utah Division of Wildlife Resources, and Utah State University.

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the usefulness of this reference. We therefore included references that would have a direct or indirect effect on the river environment and consequently on the aquatic organisms that inhabit the river. References on the ecology and life history of fish and macroinvertebrates from the lower basin or other waters were included to add to the understanding of these organisms in the upper basin. Other references were included that do not deal specifically with the upper Colorado River, but that may be valuable for interpretation.

For reports that are published annually, such as the U.S. Geological Survey water supply and aquatic records, only the latest volume was cited, together with the beginning date of the series.

Selected key words were assigned to all references and are indexed for convenience and ease in locating the literature on particular subjects. Although most of the key words are standard descriptive terms, several should be clarified for this bibliography. AGE-GROWTH refers to the age, growth, and length-weight relations of fish. ALLOCATION concerns the designation or plan of distributing natural resources, particularly water. ALTERATION applies to man-made changes of terrestrial or aquatic ecosystems. FISH-rare pertains to fish species that are few in number and that may be classified as threatened, endangered, or unique. MIGRATION refers to directed movement (usually seasonal) of animals into or from a specific area. MOVEMENT applies to a small change in location or position by an animal as compared with a longer directed movement that would be considered a migration.

We hope that this bibliography will be helpful to commissions, institutions, and state and federal agencies that will be involved in future decisions concerning the management of the aquatic resources of the Upper Colorado River Basin. Although this bibliography contains 1,109 published or readily available unpublished references, the constraints of time and space have dictated that it not be all-inclusive. We believe, however, that the compilation will provide, at a minimum, a useful starting place for anyone who has an interest in the Upper Colorado River Basin.

ACKNOWLEDGMENTS

The work reported in this paper was supported by the U.S. Fish and Wildlife Service, Contract No. 14-16-0008-1140 and the Colorado River Fishes Recovery Team. Many people at various university, state, and federal libraries or offices assisted us in locating references. Marion Hershcopf, Colorado Division of Wildlife, Fort Collins, was particularly helpful in the search of the literature. The publication costs were paid by the Office of Endangered Species, U.S. Fish and Wildlife Service, Washington, D.C. C. Banks prepared the drawing for the front cover.

1. Abbott, C. C. 1861. Descriptions of four new species of North American Cyprinidae. Proc. Phila. Acad. Nat. Sci. 12(1860): 473-474.

DESCRIPTION, FISH-rare, RIVER-Colorado

First description of the humpback sucker, Xyrauchen texanus, from the Colorado and New Rivers.

2. Adams, W. Y. 1960. Ninety years of Glen Canyon archaeology, 1869-1953 - a brief historical sketch and bibliography of archaeological investigations from J. W. Powell to the Glen Canyon Project. North. Ariz. Soc. Sci. Art, Inc. Flagstaff. 35 pp. (Also published as Mus. North. Ariz., Flagstaff, Bull. 33)

ARCHAEOLOGY, BIBLIOGRAPHY, HISTORY, RIVER-Colorado

List of expeditions and description of archaeological sites in Glen Canyon in regard to the Upper Colorado River Basin salvage project. An annotated bibliography and maps are included.

3. Ameniza, M., N. Evans, W. D. Kemper, M. M. Hastings, and C. W. Robinson. 1955. Reclamation of saline-alkali soils in the Upper Colorado River Basin. Colo. Agric. Exp. Stn., Gen. Ser. Pap. 619. 21 pp.

AGRICULTURE, MANAGEMENT, RIVER-Colorado, SOIL, WATER QUALITY

Emphasizes that the proper management of crops, soil, and water can restore production in unproductive alkali soils. Several suggested management practices included drainage by pumping and proper use of irrigation water.

4. American Society of Civil Engineers. 1966. Methods for estimating evapotranspiration. Am. Soc. Civil Eng., Irrigation and Drainage Specialty Conf., Las Vegas, Nev., Nov. 2-4, 1966. 236 pp.

VEGETATION, WATER QUANTITY

The advantages and limitations of the various methods used to measure evapotranspiration are discussed in the proceedings of this specialty conference. Water loss through this process is considerable in arid to semiarid areas of the United States such as that in the Colorado River Basin.

5. American Society of Engineers, Committee on Sedimentation. 1971. Sediment transportation mechanics: fundamentals of sediment transportation. Proc. Am. Soc. Civil Eng. 97(HY12): 1979-2022.

SEDIMENT

Reviews many aspects of sediment transport and movement of stream bedload.

6. Ames, E. L. 1977. Aquatic insects of two western slope rivers, Colorado. M.S. Thesis, Colorado State Univ., Fort Collins. 95 pp.

ABUNDANCE, DISTRIBUTION, ECOLOGY, INSECT, RIVER-White, Yampa

Provides information on the abundance and species composition of aquatic insects in the Yampa and White Rivers during a time period of one year. Diversity indices indicate that the Yampa is generally a clean river while the White is moderately polluted. The distribution, life history, and ecology of several species of mayflies are discussed as potential indicator species.

7. Ames, L. 1976. The establishment of a data baseline of the aquatic insects of the Yampa and White Rivers in northwestern Colorado. Dep. Zool. Entomol., Colorado State Univ., Fort Collins. 35 pp.

DISTRIBUTION, ENERGY, INSECT, RIVER-White, Yampa, SURVEY

Progress report on a study of aquatic insects in the Yampa and White Rivers near areas to be affected by energy development.

8. Anderson, B. W., and R. D. Ohmart. 1979. Riparian revegetation: an approach to mitigating for a disappearing habitat in the Southwest. Pages 481-487 *in* G. A. Swanson, technical coordinator. The mitigation symposium: a national workshop in mitigating losses of fish and wildlife habitats. U. S. Forest Serv., Gen. Tech. Rep. RM-65.

ALTERATION, HABITAT, RIVER-Colorado, WILDLIFE

Presents a technique for mitigating for losses of southwestern riparian habitats. This technique is based upon a pilot study of riparian vegetation on the lower Colorado River.

9. Anderson, O. L. 1975. Management of scientific collaboration in the Lake Powell Research Project. Lake Powell Res. Proj. Bull. No. 12. 19 pp.

PLAN, RESERVOIR

Provides an outline of how collaboration has been accomplished between scientists from various disciplines who are involved in research on Lake Powell.

10. Andreasen, J. K. 1973. Reproductive life history of *Catostomus ardens* and *Catostomus discobolus* in the Weber River, Utah. M. S. Thesis, Brigham Young Univ., Provo, Utah. 31 pp.

DESCRIPTION, FISH, LIFE HISTORY

Although this study involved one fish species from outside the Colorado River, *Catostomus discobolus* is found in the Colorado River Basin. The yearly reproductive cycle for these two fish was followed by a histological study of the testes and measurements of oocyte diameters. A monthly gonadal index was calculated for each sex and species. Spawning in 1972 occurred during maximum water temperature.

11. Andreasen, J. K., and J. R. Barnes. 1975. Reproductive life history of *Catostomus ardens* and *C. discobolus* in the Weber River, Utah. Copeia 1975(4): 645-648.

FISH, LIFE HISTORY

The yearly reproductive cycle in *Catostomus ardens* and *C. discobolus* was studied by means of gonad indices, histological sections of the testes, and measurements of oocyte diameters. Spermatocytes proliferate rapidly after spawning and spermatozoa overwinter in the lobules of the testes. Recruitment oocytes (diameter $<$ 0.45 mm) are present in the ovary throughout the year. The largest oocytes gradually increase in size until spawning occurs during May to July in *C. discobolus* and mid-May to June in *C. ardens*. Spawning in 1972 occurred in a period of maximum water temperature. The gonad index data correlated well with the stages of development of the testes and with increasing oocyte diameter.

12. Andrews, A. K. 1970. The distribution and life history of the fathead minnow (*Pimephales promelas* Rafinesque) in Colorado. Ph.D. Thesis, Colorado State Univ., Fort Collins. 141 pp.

ABUNDANCE, AGE-GROWTH, ECOLOGY, FISH, FOOD HABITS, LIFE HISTORY, MOVEMENT, POPULATION, SURVEY

Thorough description of the distribution and life history of the fathead minnow in Colorado, including habitat preference and relative abundance. Includes collections from the Colorado River Basin.

13. Anonymous. 1969. Water pollution studies. Colo. Dep. Game Fish Parks, Denver. Progr. Rep., Fed. Aid Proj. F-33-R-3, Jobs 1 and 2. 167 pp.

MINERAL, POLLUTION, RIVER-Dolores, WATER QUALITY

Includes water analysis for sodium, potassium, calcium, lead, iron, molybdenum, magnesium, manganese, and copper as well as stream bottom samples from the Dolores and San Miguel Rivers. This was a continuing study; other reports are available under Federal Aid Project F-33-R.

14. Armantrout, N. B. 1978. Endangered fish of the Colorado. Our Public Lands (Bur. Land Manage.) 28(2): 8-10.

FISH-rare, RIVER-Green

A popular account of the factors that have adversely affected the endemic fish of the Colorado River basin.

15. Atwood, W. W. 1909. Glaciation of the Uinta and Wasatch Mountains. U. S. Geol. Surv. Prof. Pap. 61. 96 pp. + maps + plates.

GEOLOGY, RIVER-Dolores, Duchesne, Green

Discusses the geology of the Uinta and Wasatch Mountains of Utah, which are important sources of water for the Green River and several of its tributaries.

16. Austin, L. H., and G. V. Skogerboe. 1970. Hydrologic inventory of the Uintah study unit. Utah Div. Water Resour., Salt Lake City and Utah Water Res. Lab., Utah State Univ., Logan. 199 pp.

CLIMATE, GEOLOGY, GROUNDWATER, HYDROLOGY, RUNOFF, VEGETATION, WATERSHED, WATER QUANTITY

Reviews land use patterns for the Uintah hydrological area to coordinate the planning of water resources in Utah. Also provides information on climate, precipitation, vegetative cover, and depletions of streamflow.

17. Averitt, P., and M. D. Carter. 1970. Selected sources of information on United States and world energy resources: an annotated bibliography. U. S. Geol. Surv. Circ. 641. 21 pp.

BIBLIOGRAPHY, ENERGY, RESOURCES

An annotated bibliography with selected reports that include data on energy resources, the availability and future prospects of developing each source, and overall studies of certain geographic areas, including the Colorado Basin.

18. Avery, B. 1974. Squawfish may survive. The Arizona Republic, Phoenix, Sunday, July 28, 1974: D-14.

ABUNDANCE, DISTRIBUTION, FISH, HISTORY, RIVER-Colorado

Newspaper article on the former distribution and abundance of the Colorado squawfish in the lower basin, its value as a game and food fish, and its future potential.

19. Baars, D. L., editor. 1973. Geology of the canyons of the San Juan River. Four Corners Geological Society, Durango, Colo. 94 pp.

ARCHAEOLOGY, DESCRIPTION, GEOLOGY, HISTORY, MINERAL, RECREATION, RIVER-San Juan

A river runner's guide to the San Juan River that emphasizes geological features but also provides additional comments on history, archaeology, and other topics related to this river.

20. Bagley, J. M. 1962. Developing a state water plan--summary and recommendations. Utah Water Res. Lab., Utah State Univ., Logan. PRWG 23-1. 19 pp.

MANAGEMENT, PLAN, RIVER-Colorado

Abstract of the needs, hydrologic factors, water development programs, and purposes of a water plan for the State of Utah.

21. Bagley, J. M. 1966. Proceedings of a summer institute in water resources. Utah Water Res. Lab., Eng. Dep., Utah State Univ., Logan.

Vol. 1. Philosophical, institutional, and legal aspects. 179 pp.
Vol. 2. Water quality control and management. 239 pp.
Vol. 3. General principles of water resource planning. 288 pp.

ECONOMICS, HYDROLOGY, LAW, MANAGEMENT, PLAN, RESOURCES, WATER QUALITY, WATER QUANTITY

Discussion of the many aspects in the development of water resources.

22. Bagley, J. M. 1969. A perspective of contemporary water planning and management problems in Utah. Utah Water Res. Lab., Coll. Eng., Utah State Univ., Logan. Occas. Pap. 3. 26 pp.

MANAGEMENT, PLAN, RESOURCES, WATER QUALITY, WATER QUANTITY

Broad treatment of planning and management as related to water development in Utah.

23. Bagley, M. D., C. A. Kroll, and K. Clark. 1973. Aesthetics in environmental planning. U. S. Environ. Prot. Agency, Socioeconomic Environ. Stud. Ser., EPA-600/5-73-009. 187 pp.

HISTORY, MANAGEMENT, POLICY, RECREATION

Emphasizes the relation between aesthetics to environmental planning as a man-environment interaction. Describes the historical development of the western concept of aesthetics. Reviews methods for measuring or quantifying aesthetics and provides a state of the art of research on basic theory for understanding unquantifiable factors.

24. Bailey, R. M., chairman. 1970. A list of common and scientific names of fishes from the United States and Canada, 3rd ed. Am. Fish. Soc. Spec. Pub. 6. 149 pp.

FISH

Provides the accepted common and scientific names of all fish found in the United States.

25. Baily, C., and R. Alberti. 1952. Lower Yampa River and tributaries study. Fed. Aid Proj. F-3-R-1, Colo. Game Fish Dep., Denver.

Job 1 - Physical features, pp. 154-159.
Job 2 - Fish population inventory, pp. 160-165.
Job 3 - Habitat type studies, pp. 166-177.
Job 4 - Recommendations for the initiation of stocking or other management techniques, pp. 178-180.

ABUNDANCE, DISTRIBUTION, FISH, INVERTEBRATES, RIVER-Yampa

Survey of the Yampa River, covering various topics including fish distribution, invertebrate abundance, and air and water temperatures. Colorado squawfish were reported as common between Hayden and Green River.

26. Baird, S. F., and C. Girard. 1853. Descriptions of some new fishes from the River Zuni. Proc. Phila. Acad. Sci. 6: 368-369.

DESCRIPTION, FISH, FISH-rare, RIVER-Colorado

Describes and names the first species of fishes to be identified from the Colorado River Basin. Three new species described include Gila robusta, G. elegans, and G. gracilis.

27. Baker, A. A. 1946. Geology of the Green River desert--Cataract Canyon region, Emery, Wayne, and Garfield Counties, Utah. U. S. Geol. Surv. Bull. 951. 127 pp. + maps.

GEOLOGY, MINERAL, RIVER-Dirty Devil, Green, San Rafael

Brief discussion of climate, vegetation, population, and other present-day influences. Also contains a thorough description of the geology of the Green River desert in the Cataract Canyon region of southeastern Utah.

28. Baker, B. D., R. L. Elderkin, and D. R. Dietz. 1980. The impacts of energy development on big game in northwestern Colorado. Chapter 12 in W. O. Spofford Jr., A. L. Parker, and A. V. Kneese, eds. Energy development and the water, fish, and wildlife in the Southwest: Problems of the upper Colorado River basin. Resources for the Future, Washington, D. C. In press.

ENERGY, WILDLIFE

Offers predictions on the effects of energy development in northwestern Colorado on big game populations and provides recommendations for research needs to minimize these effects. This topic is also applicable to other States in the upper Colorado River basin.

29. Ball, M. W. 1907. The western part of the Little Snake River coal field, Wyoming. U. S. Geol. Surv. Bull. 341: 243-255.

ECONOMICS, GEOLOGY, MINERAL, RESOURCES, RIVER-Yampa tributaries

Brief statement of the results of a survey made in the western part of the Little Snake River coal field, Wyoming. Geography and geology, as well as the physical properties of the coal, are discussed. A map in the text shows the main boundaries and prominent features. Finally, the relative value of the coal and its potential for development are discussed.

30. Banks, J. L. 1964. Fish species distribution in Dinosaur National Monument during 1961-1962. M.S. Thesis, Colorado State Univ., Fort Collins. 96 pp.

DISTRIBUTION, ECOLOGY, FISH, FISH-rare, FOOD HABITS, RIVER-Green

Describes the distribution of fish in the Monument prior to and after rotenone treatment of the Flaming Gorge Reservoir site. Includes habitat preferences and food habits of the Colorado squawfish and humpback sucker.

31. Banks, R. L. 1974. Flow regimes to maintain a trout fishery in the tailwater of Fontenelle Dam. Proc. Annu. Conf. West. Assoc. State Game Fish Comm. 54: 302-316.

FISHERY, RIVER-Green, STREAMFLOW

Provides data on four streamflows that were studied below Fontenelle Dam on the Green River in 1973, and recommendations for flow regimes that are necessary to maintain a trout fishery in the tailwaters of the dam.

32. Banks, R. L., J. W. Mullan, R. W. Wiley, and D. J. Dufek. 1974. The Fontenelle Green River trout fisheries--considerations in its enhancement and perpetuation including test flow studies of 1973. U. S. Fish and Wildlife Serv., Salt Lake City, Utah. 74 pp.

FISHERY, RIVER-Green, STREAMFLOW

Study of four streamflows below Fontenelle Dam on the Green River in 1973. Provides recommendations of flow regimes that are necessary to maintain a trout fishery in the tailwater area.

33. Barnhart, R. A. 1957. Chemical factors affecting the survival of game fish in a western Colorado reservoir. M.S. Thesis, Colorado State Univ., Fort Collins. 114 pp.

FISH, FISHERY, LIMNOLOGY, POLLUTION, SOIL, VEGETATION, WATER QUALITY

A study of fish mortality in Sweitzer Lake at the junction of the Uncompahgre and Gunnison Rivers, including investigations of chemical and physical requirements of introducing game fish species, ions present in the water and soil which might be toxic, and the extent to which ions are present in plants, invertebrates, and fish.

34. Barrett, W. C., and C. H. Milligan. 1953. Consumptive water use and requirements in the Colorado River area of Utah. Utah State Agric. Coll., Logan, Utah Agric. Exp. Stn. Spec. Rep. 8. 28 pp.

IRRIGATION, RIVER-Colorado, WATER QUANTITY

Summarizes the supply and demand for water from the Colorado River, with primary emphasis on use of irrigated waters for agriculture.

35. Barrows, P. T. 1953. Trout lake management studies: Forest Lake marked fish and food utilization studies. Colo. Dep. Game Fish Parks, Denver. Fed. Aid Proj. F-001-R-02, Work Plan 5, Job 2. 8 pp.

FISH, FOOD HABITS, MANAGEMENT, RIVER-Colorado Basin

Provides information on recoveries of marked brook, cutthroat, and rainbow trout, in addition to food of these species in Delta County, Colorado River Basin.

36. Barrows, P. T. 1956. Forest Lake marked fish studies. Colo. Dep. Game Fish Parks, Denver. 37 pp.

FISHERY, LIMNOLOGY, MANAGEMENT

A fishery study (summers of 1952-54) at Forest Lake, Grand Mesa, Delta County, Colorado, consisting of five phases: creel census, food use, age and growth, limnology, and a physical survey of the lake.

37. Barrows, P. T. 1962. The relationship of creel-size and two-inch plants of trout in Big Eggleston and Island Lakes, Grand Mesa, Colorado, 1953-1958. Colo. Dep. Game Fish, Tech. Bull. 13. 75 pp.

FISH, MANAGEMENT, RIVER-Colorado

Evaluation of trout plants in several lakes on the Grand Mesa.

38. Bassett, H. W. 1957. Further life history studies of two species of suckers in Shadow Mountain Reservoir, Grand County, Colorado. M.S. Thesis, Colorado State Univ., Fort Collins. 112 pp.

FISH, FOOD HABITS, LIFE HISTORY, RIVER-Colorado

Aspects of the life history (reproduction, movement, population estimate, and wintering) of the longnose and white suckers in this reservoir, which empties into the Colorado River about 1 mile south of Grand Lake Village, Colorado.

39. Bauer, D. P., T. D. Steele, and R. D. Anderson. 1978. Analysis of waste load assimilative capacity of the Yampa River, Steamboat Springs to Hayden, Routt County, Colorado. U. S. Geol. Surv., Water Resources Invest. No. 77-119. 69 pp.

POLLUTION, RIVER-Yampa, WATER QUALITY

Reviews the capacity of the Yampa River to assimilate waste loads in the reach between Steamboat Springs and Hayden, Colorado.

40. Baumann, R. W., R. N. Winget, W. H. Behle, W. F. Sigler, and G. W. Workman. 1975. Studies for wildlife on energy areas. Utah Div. Wildl. Resour., Salt Lake City, Utah. 276 pp. (Report to the U. S. Bur. Land Manage., Salt Lake City, Utah.)

DISTRIBUTION, ECOLOGY, ENERGY, FISH, INVERTEBRATE, RIVER-White, WATER QUALITY

Report consists of four parts: three parts pertain to the oil shale areas of the White River in Utah-- "Aquatic macroinvertebrates, water quality, and fish population characterization of the White River, Uintah County, Utah," "Raptor study of Utah oil shale area," and "Nongame mammal inventory of the Utah oil shale area." The physical, chemical, and biological characteristics of the White River were studied and recommendations for the ecological stability of the river were provided in the first study listed.

41. Baxter, G. T., and J. R. Simon. 1970. Wyoming fishes. Wyo. Game Fish Dep. Bull. 4. 168 pp.

DESCRIPTION, DISTRIBUTION, ECOLOGY, FISH, FOOD HABITS, KEYS, LIFE HISTORY

A revised and updated account of Wyoming's ichthyology to 1970, covering the topics provided in the key words. Photographs and distributional maps by species are included.

42. Baxter, J. D., and M. Evans. 1980. Potential impacts of energy development on population growth and the economy of the four corner states. Chapter 4 in W. O. Spofford Jr., A. L. Parker, and A. V. Kneese, eds. Energy development and the water, fish, and wildlife in the Southwest: Problems of the upper Colorado River basin. Resources for the Future, Washington, D. C. In press.

ECONOMICS, ENERGY, POPULATION

Provides a comprehensive discussion of potential changes in the population growth and economy of the upper Colorado River basin as related to energy development in this area.

43. Beattie, B. R., E. N. Castle, W. G. Brown, and W. Griffin. 1971. Economic consequences of interbasin water transfer. Oreg. Agric. Exp. Stn. Tech. Bull. 116. 82 pp.

ECONOMICS, MANAGEMENT, POLICY, WATER QUANTITY

Relates economics to the policy and management of interbasin water transfer.

44. Beckman, W. C. 1952. Guide to the fishes of Colorado. Colo. Fish Game Dep., Denver. 110 pp.

ECOLOGY, FISH, KEYS

Intended as a guide to identify fish, describe the various species of fish, and provide information on general life history. Includes species found in the Upper Colorado River Basin.

45. Behnke, R. J. 1960. Taxonomy of the cutthroat trout of the Great Basin with notes on the rainbow series. M.A. Thesis, Univ. Calif., Berkeley. 98 pp.

DISTRIBUTION, FISH, HABITAT

Taxonomic characteristics and variations of the cutthroat trout were compared for populations from the Great Basin, Lahontan system, the Bonneville system, and the Alvord Basin. The distributions of these trout and their habitat requirements are also summarized.

46. Behnke, R. J. 1968. Rare and endangered species: the native trouts of western North America. Proc. Annu. Conf. West. Assoc. State Game Fish Comm. 48: 530-533.

DESCRIPTION, FISH, RIVER-Colorado

Discusses the difficulties in classifying cutthroat trout, including several subspecies which are found in headwater streams of the Colorado River Basin.

47. Behnke, R. J. 1972. Rare and endangered trouts of the Southwest. Pages 219-133 *in* Symposium on rare and endangered wildlife in the southwestern United States. New Mexico Dep. Game Fish, Santa Fe.

DISTRIBUTION, FISH-rare, RIVER-Colorado and tributaries

Reviews the status and distribution of native trout species, including the Colorado River cutthroat trout, *Salmo clarki pleuriticus*, and greenback cutthroat trout, *Salmo clarki stomias*, that were found in the Colorado River drainage and still exist as isolated populations in some streams of Colorado, Wyoming, and Utah.

48. Behnke, R. J. 1972. The rationale of preserving genetic diversity: examples of the utilization of intraspecific races of salmonid fishes in fisheries management. Proc. West. Assoc. Game Fish Comm. 52: 559-561.

FISH-rare, GENETICS

Provides a rationale for applying behavioral, physiological, and ecological attributes of native salmonid species and subspecies in fisheries management. The subspecies of native cutthroat trout in the Colorado River drainage should be managed to maintain their genetic diversity and used in waters where they would add to the sport fishery.

49. Behnke, R. J. 1973. Bonytail chub, *Gila elegans*. Threatened and Endangered Fish Rep., Colorado Coop. Fish. Unit, Colorado State Univ., Fort Collins, for U. S. Fish Wildl. Serv., Albuquerque, New Mexico. 8 pp.

ABUNDANCE, DISTRIBUTION, ECOLOGY, FISH-rare, LIFE HISTORY, RIVER-Colorado and tributaries

Concise synopsis of the subjects listed in the key words, projected research needs, and bibliography on the bonytail chub.

50. Behnke, R. J. 1973. Colorado River cutthroat trout, *Salmo clarki pleuriticus*. Threatened and Endangered Fish Rep., Colo. Coop. Fish. Unit, Colo. State Univ., Fort Collins, for U. S. Fish Wildl. Serv., Albuquerque, New Mexico. 10 pp.

ABUNDANCE, DISTRIBUTION, ECOLOGY, FISH-rare, LIFE HISTORY, RIVER-Colorado and tributaries

Concise synopsis of the subjects listed in the key words, projected research needs, and bibliography on this supspecies of cutthroat trout.

51. Behnke, R. J. 1973. Colorado squawfish, *Ptychocheilus lucius*. Threatened and Endangered Fish Rep., Colo. Coop. Fish. Unit, Colo. State Univ., Fort Collins, for U. S. Fish Wildl. Serv., Albuquerque, New Mexico. 9 pp.

ABUNDANCE, DISTRIBUTION, ECOLOGY, FISH-rare, LIFE HISTORY, RIVER-Colorado and tributaries

Concise synopsis of the subjects listed in the key words, projected research needs, and bibliography on the Colorado squawfish.

52. Behnke, R. J. 1973. Humpback chub, *Gila cypha*. Threatened and Endangered Fish Rep., Colo. Coop. Fish. Unit, Colo. State Univ., Fort Collins, for U. S. Fish Wildl. Serv., Albuquerque, New Mexico. 5 pp.

ABUNDANCE, DISTRIBUTION, ECOLOGY, FISH-rare, LIFE HISTORY, RIVER-Colorado and tributaries

Concise synopsis of the subjects listed in the key words, projected research needs, and bibliography on the humpback chub.

53. Behnke, R. J. 1973. Humpback sucker, *Xyrauchen texanus*. Threatened and Endangered Fish Rep., Colo. Coop. Fish. Unit, Colo. State Univ., Fort Collins, for U. S. Fish Wildl. Serv., Albuquerque, New Mexico. 7 pp.

ABUNDANCE, DISTRIBUTION, ECOLOGY, FISH-rare, LIFE HISTORY, RIVER-Colorado and tributaries

Concise synopsis of the subjects listed in the key words, projected research needs, and bibliography on the humpback sucker.

54. Behnke, R. J. 1973. Kendall Warm Springs dace, *Rhinichthys osculus thermalis*. Threatened and Endangered Fish Rep., Colo. Coop. Fish. Unit, Colo. State Univ., Fort Collins, for U. S. Fish Wildl. Serv., Albuquerque, New Mexico. 4 pp.

ECOLOGY, FISH-rare, LIFE HISTORY, RIVER-Green tributary

Describes the ecology and life history of a subspecies of minnow found only in Kendall Warm Springs, Wyoming, which drains into the Green River.

55. Behnke, R. J. 1973. Utah or Bonneville cutthroat trout (*Salmo clarki utah*). Colo. Coop. Fish. Unit, Colo. State Univ., Fort Collins, for U. S. Fish Wildl. Serv., Albuquerque, New Mexico. 9 pp.

DISTRIBUTION, ECOLOGY, FISH-rare

Concise summary of the distribution, taxonomy, and ecology of the Utah or Bonneville cutthroat trout. Provides recommendations for research needs.

56. Behnke, R. J. 1975. Report on recent collections of cutthroat from the Green River Basin. Wyoming Game and Fish Department, Cheyenne. 12 pp.

DISTRIBUTION, FISH, RIVER-Green

Describes the distribution of cutthroat trout in the Green River Basin.

57. Behnke, R. J. 1976. Report on collections of cutthroat trout from Parachute Creek drainage, Garfield County, Colorado. U. S. Bur. Land Manage., Grand Junction, Colorado. 7 pp.

DISTRIBUTION, FISH, RIVER-White

Reports the distribution of cutthroat in Parachute Creek, a tributary of the White River.

58. Behnke, R. J. 1980. Livestock grazing impact on stream fisheries: problems and suggested solutions. U. S. Forest Serv., Gen. Tech. Rep. PSW. In press.

FISHERY, GRAZING, MANAGEMENT, RESOURCES

Reviews the problems that are associated with livestock grazing in western United States and provides some solutions to these problems. This information is very applicable to the Upper Colorado River. Paper presented at a workshop on "Livestock and wildlife-fisheries relationship in the Great Basin" that was held in Sparks, Nevada, during May 3-5, 1977.

59. Behnke, R. J. 1980. The impacts of habitat alterations on the endangered and threatened fishes of the upper Colorado River basin. Chapter 10 in W. O. Spofford Jr., A. L. Parker, and A. V. Kneese, eds. Energy development and the water, fish, and wildlife in the Southwest: Problems of the upper Colorado River basin. Resources for the Future, Washington, D. C. In press.

ALTERATION, FISH-rare, RIVER-Colorado

Provides an overview of the ecology of rare fish species (razorback sucker, Colorado squawfish, bonytail chub, humpback chub, and subspecies of cutthroat trout) and projects the possible impacts of further changes in their populations from various habitat alterations. Discusses the realities of coexistence of the rare fish species with the potential energy development in the upper basin.

60. Behnke, R. J., and M. Zarn. 1976. Biology and management of threatened and endangered western trouts. U. S. For. Serv., Rocky Mt. Forest Range Exp. Stn. Gen. Tech. Rep. RM-28. 45 pp.

DESCRIPTION, DISTRIBUTION, ECOLOGY, FISH-rare, LIFE HISTORY, MANAGEMENT, RIVER-Colorado

Summarizes the basic knowledge on western trouts, including the Colorado River cutthroat trout, *Salmo clarki pleuriticus*. Provides recommendations for protective measures and management.

61. Beland, R. D. 1953. The effect of channelization on the fishery of the lower Colorado River. Calif. Fish Game 39(1): 137-139.

ALTERATION, FISHERY, RIVER-Colorado

River channel dredging has decreased the value of the Colorado River as a habitat for game fishes by (1) draining the adjoining backwater lakes and sloughs; (2) eliminating riparian vegetation cover; (3) eliminating the eddies and "holes" along the river littoral zone; (4) increasing water turbidity; (5) increasing bank erosion; and (6) reducing the amount of spawning area.

62. Belknap, B. 1969. Grand Canyon river guide. Westwater Books, Boulder City, Nevada. 47 pp.

DESCRIPTION, HISTORY, RECREATION, RIVER-Colorado

Contains maps with river miles and a description of the Colorado River between Glen Canyon Dam and Lake Meade. Also provides historical information about the Grand Canyon, with numerous sketches and photographs.

63. Belknap, B., and B. Belknap. 1974. Canyonlands river guide. Westwater Books, Boulder City, Nevada. 63 pp.

DESCRIPTION, HISTORY, RECREATION, RIVER-Colorado

Provides maps with river miles and a description of the Colorado River between Westwater and Lake Powell, and historical information of the region; numerous sketches and photographs.

64. Berkman, R. L., and W. K. Viscusi. 1973. Damming the West: Ralph Nader's study group report on the Bureau of Reclamation. Grossman Publisher, New York. 272 pp.

AGRICULTURE, ALLOCATION, ALTERATION, ECOLOGY, ECONOMICS, EROSION, GEOLOGY, HISTORY, IRRIGATION, LAW, MANAGEMENT, POLICY, RECLAMATION, RESERVOIR, SALINITY, SEDIMENT, STREAMFLOW, WATER QUANTITY

Critical review of Bureau of Reclamation projects throughout the West. Problem areas discussed include salinity, sedimentation, wildlife, specific projects, Indian water rights, and water use.

65. Berwick, V. K. 1962. Floods in Utah, magnitude and frequency. U. S. Geol. Surv. Circ. 457. 24 pp.

FLOOD, HYDROLOGY, STREAMFLOW

A procedure is presented for estimating the magnitude and frequency of floods within the range of the base data, for the majority of Utah sites. Separate analysis was made for major rivers affected by diversion and regulation, or those not affected by man.

66. Bessler, M. B., and J. T. Maletic. 1975. Salinity control and federal water quality act. J. Hydraul. Div., Am. Soc. Civil Eng. 101(5): 581-594.

LAW, RIVER-Colorado, SALINITY, WATER QUALITY

Examines the salinity control problem in the Colorado River as related to the Federal Water Quality Act, PL 92-500. Concludes that some institutional changes must be made before technology and techniques can be applied to the problem.

67. Binns, N. A. 1965. Effects of rotenone treatment on the fauna of the Green River, Wyoming. M.S. Thesis, Oregon State Univ., Corvallis. 258 pp. (Also published under the same title as Wyo. Game Fish Comm., Cheyenne, Fish Res. Bull. 1. 114 pp.)

ABUNDANCE, ALTERATION, DISTRIBUTION, FISH, INVERTEBRATE, MANAGEMENT, RESERVOIR, RIVER-Green

Detailed documentation of the effects of rotenone treatment on fish and invertebrates in the Green River during an attempt to eradicate undesirable fish species before the filling of Flaming Gorge Reservoir.

68. Binns, N. A. 1967. Green River and Flaming Gorge Reservoir post-impoundment investigations: Fishery survey of Fontenelle Reservoir and the Green River downstream to Flaming Gorge Reservoir. Wyo. Game Fish Comm., Cheyenne, Prog. Rep. 4, Addendum. 86 pp.

FISH, INVERTEBRATE, LIFE HISTORY, LIMNOLOGY, MANAGEMENT, PLANKTON, RIVER-Green, SURVEY

Summarizes a study of the biota and limnology of Fontenelle Reservoir and the Green River in 1965-67.

69. Binns, N. A. 1972. An inventory and evaluation of the game and fish resources of the Upper Green River in relation to current and proposed water development programs. Ph.D. Thesis, Univ. Wyo., Laramie. 196 pp. (Also published in a Completion Report to the Office of Water Resour. Res., Contract #14-01-001-1568, and Wyo. Game Fish Comm. Proj. #B-002-WYO.)

ECONOMICS, FISH, MANAGEMENT, RECREATION, RESOURCES, RIVER-Green, WATER QUALITY, WATER QUANTITY, WILDLIFE

An inventory (1967-70) of the fish and wildlife resources in the upper Green River to evaluate the general quality of these resources and predict effects of future water development. Compares standing crop ratios, condition factors, harvest, and numbers of bottom fauna for various sections of the Green River and other streams.

70. Binns, N. A. 1977. Present status of indigenous populations of cutthroat trout, *Salmo clarki*, in southwest Wyoming. Wyoming Game Fish Dep., Cheyenne, Fish. Tech. Bull. 2. 58 pp.

DISTRIBUTION, FISH, HABITAT, MANAGEMENT, RIVER-Green, Yampa

The Colorado River cutthroat trout (*Salmo clarki pleuriticus*) is the only native trout of the upper Colorado River basin. In Wyoming, this species is presently found only in a few isolated, headwater tributaries of the Green, Black's Fork, and Little Snake Rivers. Twelve streams and two lakes have cutthroat stocks judged to be pure, or essentially pure, strains of *S. c. pleuriticus*. Populations having slight to moderate traces of hybridization with other *Salmo* species occur in an additional 22 waters. This trout currently utilizes a wide varity of habitats -- lakes, small streams, and beaver dam complexes. The stream habitat of this species usually contains a limited amount of water -- often average daily flows are less than 0.14 cm/s. The present status of this trout can be described as sensitive and further losses to remaining habitat or stocks will very likly warrant classification of this species as threatened or endangered.

71. Binns, N. A. 1977. Evaluation of trout habitat that would be impacted by Cheyenne's proposed Phase II water development in the North Fork Little Snake drainage. Admin. Rep., Proj. No. 5076-09-6002, Wyoming Game Fish Dep., Cheyenne. 21 pp.

FISH-rare, HABITAT, RECLAMATION, STREAMFLOW

Discusses the potential impact of water development in the Little Snake River, Wyoming, on the rare Colorado River cutthroat trout (*Salmo clarki pleuriticus*).

72. Binns, N. A. 1978. Habitat structure of Kendall Warm Springs, with reference to the endangered Kendall Warm Springs dace, *Rhinichthys osculus thermalis*. Wyoming Game Fish Dep., Cheyenne, Fish. Tech. Bull. 4. 45 pp.

FISH-rare, HABITAT, LIMNOLOGY, RIVER-Green

The 300-m- (984-ft-) long creek formed by the spring flow constitutes the sole habitat for the endangered Kendall Warm Springs dace. Adult dace ranged from 23 mm to 54 mm and averaged 39 mm in total length. Lentic pockets in beds of aquatic plants located alongside the main current were used extensively by fry, while adult dace preferred mainstream eddies and pools. Tiny, apparently newly hatched fry were observed in the nursery areas at all seasons, which indicated several spawnings per year. The water temperature of the creek varied less than 10% from source (29.4C) to its confluence with the Green River. Dissolved oxygen ranged from 0.55 mg/l at the spring source to supersaturation in the lower creek.

73. Binns, N. A., F. Eiserman, F. W. Jackson, A. F. Regenthal, and R. Stone. [1963.] The planning, operation, and analysis of the Green River Fish Control Project. Joint Rep. Utah State Dep. Fish Game, Salt Lake City, and Wyo. Game Fish Dep., Cheyenne. 83 pp.

ALTERATION, FISH, FISHERY, MANAGEMENT, RESERVOIR, RIVER-Green

Presents the operational details of the rotenone treatment of the Green River before the filling of Flaming Gorge Reservoir, including a pretreatment survey with a list of species.

74. Bishop, A. A. 1971. Conflicts in water management. 42nd Honor Lecture, The Faculty Assoc., Utah State Univ., Logan. 29 pp.

AGRICULTURE, FISH, FLOOD, IRRIGATION, MANAGEMENT, WATER QUALITY, WATER QUANTITY

An overview of the countless factors that bring about conflict in the management of our country's water resources. Concluded that management's decisions of water resource allocation and control must be fully justified and supported by society.

75. Bishop, A. B., M. D. Chambers, W. O. Mace, and D. W. Mills. 1975. Water as a factor in energy resources development. Utah Water Res. Lab., Utah State Univ., Logan. PRJERO 28-1. 104 pp.

ALLOCATION, ENERGY, MANAGEMENT, MODEL, RIVER-Colorado, WATER QUALITY, WATER QUANTITY

Summary of a linear programming approach used in analyzing water resource interrelations that may be used in trade-offs concerning conflicts on water resource allocation.

76. Bishop, A. B., and D. B. Porcella. 1980. Physical and ecological aspects of the upper Colorado River basin. Chapter 2, in W. O. Spofford Jr., A. L. Parker, and A. V. Kneese, eds., Energy development and the water, fish, and wildlife in the Southwest: Problems of the upper Colorado River basin. Resources for the Future, Washington, D. C. In press.

ALTERATION, ECOLOGY, RIVER-Colorado

Provides an overview of the development and environmental change that has occurred in the upper Colorado River basin and suggestions for environmental research needs.

77. Biswas, A. K., and R. W. Durie. 1971. Sociological aspects of water development. Water Resour. Bull. 7(6): 1137-1143.

RECLAMATION, RESERVOIR, RIVER-Colorado, Green, SOCIOLOGY, WATER QUANTITY

Reviews the sociological aspects of water development with reference to public opinion, economics, and politics. Includes this kind of information on Glen Canyon and Flaming Gorge Dams on the Colorado River and Starvation Reservoir in Utah.

78. Bjorklund, L. J. 1969. Reconnaissance of the ground-water resources of the upper Fremont River Valley, Wayne County, Utah. Utah Dep. Nat. Resour. Tech. Publ. 22. 54 pp.

GROUNDWATER, HYDROLOGY, RIVER-Colorado, Dirty Devil, WATER QUALITY

Discusses the sources and uses of the groundwater and surface water in the Fremont River, a drainage of the Dirty Devil River.

79. Black, J. E., and C. W. Howe. 1974. Salinity of water resources. Univ. Colorado, Boulder. Proc. Annu. Conf. West. Resour. 15(1973). 177 pp.

AGRICULTURE, ECONOMICS, MANAGEMENT, MODEL, RIVER-Colorado, SALINITY, WATER QUALITY

Summarizes the practices used to deal with the salinity problem in the Colorado River Basin. Discusses agricultural damage caused by salinity and provides new concepts and findings from experience in irrigation practices.

80. Black, W. C., Jr., J. V. Rouse, G. R. Schillinger, and W. H. Shafer, Jr. 1973. Mineral pollution in the Colorado River Basin. J. Water Pollut. Control Fed. 45(7): 1517-1557.

GEOLOGY, HYDROLOGY, IRRIGATION, MINERAL, POLLUTION, RIVER-Colorado and tributaries, SALINITY, SEDIMENT, WATER QUALITY, WATER QUANTITY

Extensive field investigations were carried out as part of the Colorado River Basin Water Quality Control Project to determine the location, magnitude, and causes of interstate pollution of the Colorado River and its tributaries. The damages caused by mineral pollution were evaluated and programs were recommended for control of interstate water pollution.

81. Blackwelder, E. 1934. Origin of the Colorado River. Geol. Soc. Am. Bull. 45: 551-566.

GEOLOGY, RIVER-Colorado

Discussion of the origins of the Colorado River after the late Miocene.

82. Blaney, H. F. 1961. Consumptive use and water waste by phreatophytes. Am. Soc. Civil Eng., Irrig. Drain. Div. 87(3): 34-46.

VEGETATION, WATER QUALITY

Water losses by phreatophytes are most acute in areas in which water supplies are limited. It is estimated that these plants consume nearly 25 million acre-ft. of water annually in the western United States. Measurements of consumptive use and estimates of consumptive waste that might be salvaged for beneficial use are presented.

83. Blaney, H. F., and W. D. Criddle. 1962. Determining consumptive use and irrigation water requirements. U. S. Dep. Agric. Tech. Bull. 1275. 59 pp.

IRRIGATION, WATER RESOURCE

The climatic factors believed to have the greatest effect on consumptive use, on which data are generally available, are temperature, precipitation, humidity, wind movement, and growing season. Irrigation practices, as well as kind of crops grown, their stage of growth, and species, also influence the amount of water consumed. This report gives an empirical formula for the relation between temperature, length of growing season, monthly percentage of annual daytime hours, and consumptive use of water. From this relation, consumptive use of water by crops and natural vegetation, and irrigation requirements, can readily be estimated for any area where the basic climatological data are available.

84. Boeker, H. M. 1953. Waterfowl production in the Yampa River Valley, Colorado. M. S. Thesis, Colorado State Univ., Fort Collins. 117 pp.

RIVER-Yampa, WILDLIFE

Study of waterfowl produced on the Yampa River.

85. Bolke, E. L. 1976. Chemical and physical data for the Flaming Gorge Reservoir Area. Utah and Wyoming, 1973-75. U. S. Geol. Surv., Salt Lake City, Utah, Utah Basic Data Release 27. 35 pp.

HYDROLOGY, RESERVOIR, RIVER-Green, WATER QUALITY

Summary of chemical and physical data for Flaming Gorge Reservoir in 1973-75.

86. Bolke, E. L., and K. M. Waddell. 1972. Water-quality data for the Flaming Gorge Reservoir area, Utah and Wyoming, 1969-72. U. S. Geol. Surv., Salt Lake City, Utah. Utah Basic-Data Release 24. 50 pp.

HYDROLOGY, RESERVOIR, RIVER-Green, WATER QUALITY

Summary of basic water quality data collected by the U. S. Geological Survey in Flaming Gorge Reservoir from October 1970 to September 1972.

87. Bolke, E. L., and K. M. Waddell. 1975. Chemical quality and temperature of water in Flaming Gorge Reservoir, Wyoming and Utah, and the effect of the reservoir on the Green River. U. S. Geol. Surv., Water-Supply Pap. 2039-A. 26 pp.

RESERVOIR, RIVER-Green, TEMPERATURE, WATER QUALITY

Provides information on water temperature and water chemistry of Flaming Gorge Reservoir. Also describes the effect of the reservoir on the Green River.

88. Bosley, C. E. 1960. Pre-impoundment study of the Flaming Gorge Reservoir. Wyo. Game Fish Comm., Cheyenne. Fish. Tech. Rep. 9. 81 pp.

DISTRIBUTION, FISH, FISHERY, INVERTEBRATE, LIMNOLOGY, PLANKTON, RIVER-Green, SURVEY

A biological, chemical, and physical survey of the Flaming Gorge Reservoir site before impoundment, from La Barge, Wyoming, downstream to the dam site.

89. Bowden, C. 1975. The impact of energy development on water resources in arid lands: Literature review and annotated bibliography. Office of Arid Lands Studies, Univ. Ariz. Tucson. Information paper to U. S. Office Water Res. Technol., Washington, D. C. Contract DI-14-31-0001-4258, and Natl. Tech. Inf. Serv., Springfield, Va. PB-240 008/3 ST. 288 pp.

BIBLIOGRAPHY, ENERGY, MANAGEMENT, POLLUTION, RIVER-Colorado, WATER QUALITY, WATER RESOURCE

Water is basic to energy conversion systems, natural and man-made. Consequences of energy extraction and conversion in arid lands where water is scarce are explored. The historical past is used as a record for casting model development plans into perspective; the worldwide growth in energy consumption rates is considered as the motive force behind many current energy projects in arid lands. Energy sources (coal, oil, gas, oil shale, solar energy, and alternative energy sources--fission, fusion, and geothermal) are reviewed in terms of their consequences on the air, land, water, and inhabitants of such regions. Two rivers, the Colorado and the Missouri, provide small-scale models of the rewards and hazards of heavily exploiting water-short areas. In both instances, energy development plans, as now proposed, will seriously deplete the water supply; alter the quality of the water, land, and air; and increase the human population.

90. Box, T. W. 1977. The arid lands revisited 100 years after John Wesley Powell. 57th Annu. Faculty Honor Lecture, Utah State Univ., Logan. 30 pp.

DESCRIPTION, ECOLOGY, HISTORY, RIVER-Colorado

Reviews the characteristics of the arid lands of the Colorado River basin and the history of use as related to the ecological potential of these lands.

91. Boyd, R. J. 1970. Elk of the White River Plateau, Colorado. Colo. Div. Game Fish Parks, Denver. Tech. Pub. 25. 126 pp.

DESCRIPTION, ECOLOGY, HISTORY, MOVEMENT, POPULATION, RIVER-White, WILDLIFE

Summary of all pertinent information available through 1965 on the ecology of the elk on the White River Plateau in northwestern Colorado. This herd is considered the largest and most valuable in Colorado.

92. Boyd, R. J. 1974. Upper Roaring Fork environmental impact study. Colo. Div. Wildl., Denver, Div. Rep. 1. 81 pp.

HISTORY, RECREATION, WILDLIFE

Provides historical data for the wildlife resources in the Roaring Fork and Crystal River valleys and projects the recreational needs of the area.

93. Bradley, I. E., and J. P. Gander. 1968. The economics of water allocation for the State of Utah using input-output analysis. Univ. Utah, Bur. Econ. Research, Center for Econ. Commun. Develop., Salt Lake City. 81 pp.

ALLOCATION, ECONOMICS, MANAGEMENT, MODEL, POPULATION, WATER QUANTITY

Analyzes the problem of estimating the increase in the amount of water intake demanded by each industrial sector and by the State as a whole as a result of the economic expansion of Utah over the period, 1963-75, with the use of an input-output model. The existing pattern of water allocation is reviewed and conclusions and results of the forecast are presented.

94. Bradley, W. H. 1963. Paleolimnology. Pages 621-652 in D. G. Frey, ed. Limnology in North America. Univ. Wisconsin Press, Madison.

GEOLOGY, LIMNOLOGY, RIVER-Green

Review of paleolimnology, including the lake sediments and duration of Gosiute Lake in Wyoming, Colorado, and Utah. Also provides the chemical composition of the sediments of ancient Gosiute Lake.

95. Bradley, W. H. 1964. Geology of Green River formation and associated Eocene rocks in southwestern Wyoming and adjacent parts of Colorado and Utah. U. S. Geol. Surv. Prof. Pap. 496-A. 86 pp. + maps + plates.

ARCHAEOLOGY, GEOLOGY, MINERAL, RIVER-Green

The geology of Eocene rocks in an area of about 17,000 square miles is discussed. The purpose of the report is to provide the geologic foundation necessary to understand and reconstruct the conditions under which the Green River and Wasatch and Bridger formations came into being and to provide a matrix in which geochemists and mineralogists studying parts of the area can set up their models.

96. Bradley, W. H. 1965. Geochemistry and paleolimnology of the trona deposits and associated authigenic minerals of the Green River formation, Wyoming. U. S. Geol. Surv. Prof. Pap. 496B. 71 pp.

GEOLOGY, MINERALS, RIVER-Green, SALINITY

Summarizes the geochemistry of the trona beds and associated saline minerals of the Green River formations in southeastern Wyoming.

97. Branson, B. A. 1961. Observations on the distribution of nuptual tubercles in some catostomid fishes. Trans. Kans. Acad. Sci. 64: 360-372.

FISH

Describes the location of tubercles on some catostomid fishes from the eastern United States, with a brief statement about the distribution of tubercles on Xyrauchen and Pantosteus.

98. Branson, B. A. 1966. Some rare and vanishing fishes. Bioscience 16: 611-613.

DESCRIPTION, FISH-rare

Contains photographs of Colorado squawfish and flannelmouth suckers, which are found in the Upper Colorado River Basin.

99. Branson, B. A. 1973. Fishes of our arid lands. Natl. Parks Conserv. Mag. 47(11): 22-24.

ABUNDANCE, FISH, MANAGEMENT, RIVER-Colorado

Popular article describing the decline of native fish populations in the Colorado River Basin and other drainages in the Southwest.

100. Branson, B. A., and C. J. McCoy, Jr. 1966. Observations on breeding tubercles in *Xyrauchen texanus* (Abbott). Southwest. Nat. 11(2): 301.

FISH-rare, RIVER-Green

Description of tubercle arrangement on one male *Xyrauchen texanus* collected from Dinosaur National Monument, Utah-Colorado.

101. Branson, B. A., and J. B. Owen. 1970. Plant cover, runoff, and sediment yield relationships on Mancos Shale in western Colorado. Water Resour. Res. 6(3): 783-790.

RUNOFF, SEDIMENT

Provides correlation analyses of the relation between vegetation and hydrologic measurements for 17 watersheds near Grand Junction, Colorado. Highly significant correlation coefficients were found between percent bare soil and runoff, but relations between bare soil and sediment yields were nonsignificant. Geomorphic factors (e.g., angle of function near slope, drainage density, relief ratio, length-width ratio, and watershed area) were more highly correlated with sediment yields than with runoff.

102. Branson, B. A., M. E. Sisk, and C. J. McCoy, Jr. 1966. *Ptychocheilus lucius* from Salt River, Arizona. Southwest. Nat. 11(2): 300.

FISH-rare, RIVER-Colorado tributary

On 24 August 1958, seven Colorado squawfish were collected from the Salt River below the U. S. 60 Highway bridge, Glove County, Arizona. None were found in July 1964.

103. Breder, C. M., Jr., and D. E. Rosen. 1966. Modes of reproduction in fishes. The Natural History Press, Garden City, N. Y. 941 pp.

FISH, LIFE HISTORY

A discussion of reproduction in fishes which can be applied to species found in the Colorado River Basin.

104. Bresler & Associates, Inc., New York. 1975. Potential application of ion exchange desalting for salinity control in the Colorado River Basin. U. S. Bur. Reclam., Salt Lake City, Utah. 127 pp.

IRRIGATION, RIVER-Colorado, SALINITY

Evaluation of ion exchange technology for salinity control, with potential application to the Colorado River.

105. Breternitz, D. A. 1970. Archaeological excavations in Dinosaur National Monument, Colorado-Utah, 1964-1965. Univ. Colorado Press, Boulder. 167 pp.

ARCHAEOLOGY, RIVER-Green, Yampa

Gives historical information on archaeological sites found in Dinosaur National Monument.

106. Brittan, M. R. 1960. A probability model for integration of Glen Canyon Dam into the Colorado River system. Ph.D. Thesis, Univ. Colorado, Boulder. 173 pp.

MODEL, RESERVOIR, RIVER-Colorado

A model that incorporates Glen Canyon Dam in the Colorado River Basin.

107. Brittan, M. R., L. W. Crow, M. E. Garnsey, P. R. Julian, R. A. Schleusener, and V. M. Yeodjevish. 1961. Past and probable future variations in stream flow of the Upper Colorado River. Bur. Econ. Res., Univ. Colorado, Boulder.

Part I.	Summary and conclusions. 24 pp.
Part II.	A study of the statistical predictability of stream runoff in the Upper Colorado River Basin. 98 pp.
Part III.	Some general aspects of fluctuations of annual runoff in the Upper Colorado River Basin. 48 pp.
Part IV.	Probability analyses applied to the development of synthetic hydrology for the Colorado River. 99 pp.
Part V.	Analysis of precipitation data in the Upper Colorado River Basin. 34 pp.

HYDROLOGY, PRECIPITATION, RIVER-Colorado, RUNOFF, STREAMFLOW

Review of the past streamflow with variations of the upper Colorado River and study of the precipitation and predictability of streamflow.

108. Brobst, D. S., W. P. Pratt, and V. E. McKelvey. 1973. Summary of United States mineral resources. U. S. Geol. Surv. Circ. 682. 19 pp.

MINERAL, RESOURCES

Lists the mineral resources found in the United States including those found in the Colorado River Basin.

109. Brookshire, D. S., W. D. Schulze, and B. C. Ives. 1976. The impact of energy development on recreation use and value in the Glen Canyon National Recreation Area. Univ. Calif. Inst. Geophys., Lake Powell Res. Proj. 33. 62 pp.

ECONOMICS, ENERGY, FISHERY, RECREATION, RESERVOIR, RIVER-Colorado, SURVEY

Discusses the recreational use and value of Lake Powell (Glen Canyon National Recreation Area) as well as the effect that energy development could have on recreation on this reservoir.

110. Brown, H. E., and E. G. Dunford. 1956. Streamflow in relation to extent of snow cover in central Colorado. U. S. For. Serv., Rocky Mt. For. Range Exp. Stn. Pap 24. 9 pp.

PRECIPITATION, RIVER-Colorado, STREAMFLOW

Report on study in 1950 of the St. Louis Creek watershed, which drains into the Colorado River drainage. Site was 9,000 to 12,790 feet in elevation and 32.8 square miles in area.

111. Bryant, H. C. 1930. Colorado River trout captured in Imperial County, California. Calif. Fish Game 16(2): 183.

DISTRIBUTION, FISH-rare

Provides a record of Salmo clarki pleuriticus from an irrigation ditch that connects with the Colorado River.

112. Buckhouse, J. C. 1980. Livestock grazing and some watershed management implications. U. S. Forest Serv., Gen. Tech. Rep. PSW- In Press.

GRAZING, MANAGEMENT, WATERSHED

Reviews the impact of livestock grazing as related to watershed management in the western United States. This information is applicable to the Upper Colorado River Basin. Paper presented at a workshop on "Livestock and wildlife-fisheries relationship in the Great Basin" that was held in Sparks, Nevada, during May 3-5, 1977.

113. Burdick, B. D. 1979. Biology, reproductive potential, and the impact of fishing pressure on the bluegill fishery of Pelican Lake, Uintah County, Utah. M. S. Thesis, Utah State Univ., Logan. 235 pp.

FISH, LIFE HISTORY, RECREATION

Provides detailed information on the biology (age and growth, sex ratio, size and age at sexual maturity, fecundity, standing crops) of the bluegill from a lake that drains into the Green River. Also contains a comprehensive summary of the fishery for this warmwater species from an intensive creel check that provides information on the angler pressure, catch per effort, and estimated losses to the fishery due to hooking mortality.

114. Burgh, R. F. 1948. The archaeology of Castle Park, Dinosaur National Monument. Univ. Colorado Press, Boulder. 102 pp.

ARCHAEOLOGY, RIVER-Yampa

Describes the archaeology of the Castle Park area on the Yampa River.

115. Burkhard, W. T. 1966. Stream fishery studies; statewide stream surveys. Fed. Aid Rep. F-26-R-3, Job 1. Colo. Dep. Game Fish Parks, Denver. 166 pp.

ABUNDANCE, DESCRIPTION, DISTRIBUTION, INVERTEBRATE, RIVER-Dolores, Yampa

Provides a survey of the Yampa and Dolores Rivers and tributaries, among others, with a description of the area and estimates of abundance of invertebrates. Federal Aid Rep. F-26-R-1 and F-26-R-2 are earlier progress reports on this project.

116. Burkhard, W. T. 1967. Stream fishery studies: Effects of channelization of the trout fishery of Tomichi Creek. Fed. Aid Proj. F-026-R-04/Job 06. Colo. Dep. Game Fish Parks, Denver. 9 pp.

ALTERATION, FISH, INVERTEBRATE, RIVER-Colorado, STREAMFLOW

Evaluates the effects of stream channelization on the fish and invertebrates of Tomichi Creek in Saguache County, Colorado River Basin. Also provides information on the age and growth of brown and rainbow trout from this stream.

117. Burkhard, W. T. 1977. Taylor River flow investigations. Colo. Dep. Nat. Resour., Div. Wildl., Denver. Job Interim Rep., Fed. Aid Proj. F-51-R-4, Job 1. 49 pp.

ABUNDANCE, FISH, HYDROLOGY, INVERTEBRATE, RECREATION, RIVER-Gunnison tributary, STREAMFLOW, TEMPERATURE, WATER QUALITY

Provides baseline information on selected biological and physical factors in the Taylor River during 1973-75. Summarizes information on the hydrology, water temperature, water quality, macroinvertebrates, and the natural brown trout population.

118. Burkhard, W. T., and R. R. Hill. 1967. Stream fisheries studies: White River survey. Fed. Aid Proj. F-26-R-3, Job 2. Colo. Div. Wildl., Denver. 29 pp.

FISH, INVERTEBRATE, STREAMFLOW, WATER QUALITY

This survey provides information on streamflow, water chemistry, fish, and aquatic invertebrates from nine stations on the South Fork of the White River and Sweetwater Creek. The study was a part of the Yellow Jacket Unit of the White-Yampa River water development project by the U. S. Bureau of Reclamation.

119. Burkhard, W. T., and T. A. Lytle. 1978. Final report for fish and wildlife resource analysis of the West Divide Project. Colo. Dep. Nat. Resour., Div. Wildl., Grand Junction. 310 pp.

FISH, HYDROLOGY, INVERTEBRATE, RIVER-Colorado, STREAMFLOW, VEGETATION, WILDLIFE

Describes in detail the fish and wildlife resources found in the Colorado River Valley between Glenwood Springs and De Beque. Discusses the effects of water development in the West Divide Project by the U. S. Bureau of Reclamation and possible mitigation for such losses.

120. Burkhard, W. T., N. F. Smith, Jr., T. A. Lytle, and H. E. Burdick, Sr. 1979. Final report for fish and wildlife resource analysis of the Grand Mesa Project. Colo. Dep. Nat. Resour., Div. Wildl., Grand Junction. 515 pp.

FISH, INSECT, HYDROLOGY, RIVER-Gunnison, VEGETATION, WILDLIFE

Detailed description of the fish and wildlife resources that are present in the area to be developed during the Grand Mesa Project. Discusses the potential impact of this U. S. Bureau of Reclamation project on fish and wildlife and suggests mitigation measures that can be taken for such losses.

121. Burton, L. A. 1970. A geographical study of the alkaline soils of the Duchesne-Roosevelt area. M. S. Thesis, Univ. Utah, Salt Lake City. 111 pp.

AGRICULTURE, GEOLOGY, RECLAMATION, SALINITY, SOIL

A study of the soils and soil alkalinity of the Duchesne-Roosevelt area of the Uinta Basin, Utah, in the northernmost section of the Colorado Plateau. Discusses physical factors, human occupation, alkalinity and salinity problems, and reclamation efforts.

122. Bussey, R. E., D. E. Kidd, and C. D. Potter. 1976. The concentrations of ten heavy metals in some selected Lake Powell game fishes. Lake Powell Res. Proj. Bull. 34. 72 pp.

FISH, MINERAL, RESERVOIR, RIVER-Colorado

Summarizes the concentrations of arsenic, cadmium, calcium, chromium, copper, iron, lead, magnesium, selenium, and zinc in largemouth bass, black crappie, and rainbow trout from Lake Powell.

123. Butler, B. S., G. F. Laughlin, V. C. Heikes, and others. 1920. The ore deposits of Utah. U. S. Geol. Surv. Prof. Pap. 111. 672 pp.

BIBLIOGRAPHY, GEOLOGY, HISTORY, MINERAL

Describes the mineral belts in Utah and relation of ore deposits within these belts as well as the geography and physiographic development of Utah. Provides a bibliography of Utah geology from 1732 to 1917 and a history of ore production.

124. Campbell, C. J. 1970. Ecological implications of riparian vegetation management. J. Soil Water Conserv. 25(2): 49-52.

ECOLOGY, MANAGEMENT, VEGETATION, WATER QUANTITY

Reviews the importance of riparian vegetation on watershed management including water yield, effects of phreatophytes, forest management, and land management.

125. Canton, S. P., and J. V. Ward. 1978. Environmental effects of western coal surface mining. Part II - The aquatic macroinvertebrates of Trout Creek, Colorado. U. S. Environ. Protect. Agency, EPA-600/3-78-095. 73 pp.

INSECT, INVERTBRATE, MINERAL

Marked seasonal variation occurred in the density of macroinvertebrates in Trout Creek, Colorado. Aquatic insects composed over 90% of the fauna; caddisflies (Trichoptera) were the dominant forms. Diversity did not differ significantly throughout the study area. Water quality diminished primarily during spring runoff and the invertebrates appeared to tolerate the short period of water degradation. The buffer zone between the mine area and Trout Creek apparently decreased the effects of mine drainage on the macroinvertebrate community.

126. Carlander, K. D. 1969. Handbook of freshwater fishery biology. Vol. 1: Life history data on freshwater fishes of the United States and Canada, exclusive of the Perciformes. Iowa State Univ. Press, Ames. 752 pp.

AGE-GROWTH, FISH, FOOD HABITS, LIFE HISTORY

Contains extensive life history data and references on the freshwater fishes from the United States and Canada, exclusive of the Perciformes, including species found in the Upper Colorado River Basin.

127. Carlander, K. D. 1977. Handbook of freshwater fishery biology. Vol. 2: Life history data on centrarchid fishes of the United States and Canada. Iowa State Univ. Press, Ames. 431 pp.

AGE-GROWTH, FISH, FOOD HABITS, LIFE HISTORY

Contains extensive life history data and references on the freshwater fishes in the family Centrarchidae from the United States and Canada, including species found in the Upper Colorado River Basin.

128. Carlson, C. A., C. G. Prewitt, D. E. Snyder, E. J. Wick, E. L. Ames, and W. D. Fronk. 1979. Fishes and macroinvertebrates of the White and Yampa Rivers, Colorado. Final Rep., U. S. Dep. Int., Bur. Land Manage. Proj. 31-1474-1744. Dep. Fish Wildl. Biol., Colorado State Univ., Fort Collins. 72 pp.

ABUNDANCE, AGE-GROWTH, FISH, INSECT, RIVER-White, Yampa

Fish and macroinvertebrates were sampled in the Yampa and White Rivers between July 1975 and September 1978. Flannelmouth, white, and bluehead suckers, redside shiners, fathead minnows, and speckled dace were most commonly collected from the Yampa River. Flannelmouth suckers, mountain whitefish, and speckled dace were most abundant in the White River. Growth of mountain whitefish and flannelmouth suckers was relatively slow after the first and third years of life, respectively. Growth of white suckers was similar to that reported in other streams, and Colorado squawfish in the Yampa River grew faster than squawfish collected in the Green River in 1964-76. Mayflies were the predominant aquatic macroinvertebrates in both streams, and caddisflies and true flies were next in abundance. Data are provided on the water quality in the two rivers.

129. Carlson, C. A., C. G. Prewitt, D. E. Snyder, E. J. Wick, E. L. Ames, and W. D. Fronk. 1979. Fishes and macroinvertebrates of the White and Yampa Rivers, Colorado. U.S. Bur. Land Manage., Denver, Colo., Biol. Sci. Series No. 1. 276 pp.

AGE-GROWTH, DISTRIBUTION, FISH, FISH-rare, FOOD HABITS, HABITAT, INSECT, INVERTEBRATE, RIVER-White, Yampa, TEMPERATURE, WATER QUALITY

Describes an aquatic inventory of the Yampa River between Lily Park Pool near Cross Mountain Canyon and Hayden, Colorado, and of the White River between Spring Creek and Rio Blanco Lake. Eighteen Colorado squawfish were collected from the two rivers during July 1975 and September 1978. The age and growth of Colorado squawfish, flannelmouth suckers, and mountain whitefish was determined and foods eaten by channel catfish, bluehead and flannelmouth suckers, and red shiners were summarized.

130. Carlson, W. L., and A. T. Cringan. 1975. Oil shale development and wildlife in northwestern Colorado. Wildl. Soc. Bull. 3(1): 7-12.

ENERGY, MINERAL, RIVER-Colorado, White, WILDLIFE

The development of an oil shale industry in the Piceance Basin of northwestern Colorado is expected to adversely affect most of the resident mammal and bird species regularly occurring in this area. Offers recommendations for mitigation that may reduce some negative impacts.

131. Carroon, L. E. 1970. Correlative estimates of streamflow in the upper Colorado River Basin. U. S. Geol. Surv. Water-Supply Pap. 1875. 145 pp. + map.

RIVER-Colorado, STREAMFLOW

Provides correlative estimates of monthly mean discharge at discontinued streamflow gauging stations, in the areas of Arizona, Colorado, New Mexico, Utah, and Wyoming from which waters naturally drain into the Colorado River above Lee's Ferry.

132. Carter, J. R., and A. R. Green. 1963. Floods in Wyoming, magnitude and frequency. U. S. Geol. Surv. Circ. 478. 27 pp.

FLOOD, HYDROLOGY

Methods are described for estimating the magnitude of a flood of any frequency for any site, gauged or ungauged, on most unregulated streams in Wyoming within the limits of basin size for which records have been collected for 1 to 50 years. Defines relations of the mean annual flood as the dependent variable to certain basin characteristics as independent variables. Curves are presented showing the ratio of floods of selected frequencies to the mean annual flood used as an index.

133. Casey, H. E. 1972. Salinity problems in arid lands irrigation: a literature review and selected bibliography. Univ. Ariz. Inst. Arid Lands Res. Inf. Pap. 1. 311 pp. (Also, Natl. Tech. Inf. Serv., Springfield, Va. PB-214 172/9.)

BIBLIOGRAPHY, ECONOMICS, IRRIGATION, LAW, MANAGEMENT, RECLAMATION, SALINITY, SOCIOLOGY, WATER QUALITY

Bibliography of 986 references with a review of such broad topics as (1) water quality of the total drainage basin, (2) control of salinity and soil reclamation, (3) effects of drought on salts in plants, soil, and water, (4) basic water balance problems related to irrigation, and (5) historical perspective of problems caused by salinity. The Colorado River Basin was used as an example of a microcosm in which socioeconomic factors are considered.

134. Cashion, W. B. 1964. The distribution and quality of oil shale in the Green River Formation of the Uinta Basin, Utah-Colorado. Pages 86-89 in Geological Survey Research 1964, Chapter D. U. S. Geol. Surv. Prof. Pap. 501D.

DISTRIBUTION, MINERAL

Describes the oil-shale beds in Utah and Colorado. Incomplete bioassay data indicate an average oil yield of 15 gallons per ton or about 321 billion barrels of oil in this area that could be used as a source for liquid synthetic fuel.

135. Cashion, W. B. 1967. Geology and fuel resources of the Green River Formation, southeastern Uinta Basin, Utah and Colorado. U. S. Geol. Surv. Prof. Pap. 548. 48 pp. + maps + plates.

GEOLOGY, MINERAL

Data on the stratigraphic distribution, continuity, areal extent, thickness, and oil content of oil-shale beds in the area.

136. Chadwick, D. G. 1968. Electronic analog simulation of the salinity flow system within the upper Colorado River Basin. First Annual Progress Report, FWPCA Demonstration Project WPD 178-01-67. Utah Water Res. Lab., Utah State Univ., Logan. 73 pp.

HYDROLOGY, MODEL, RIVER-Colorado, SALINITY, STREAMFLOW, WATERSHED

Collection and analysis of the hydrologic and salinity data that are required for the simulation of the individual subbasins of the Upper Colorado River with analog computer submodels.

137. Chamberlain, F. M. 1904. Notes on fishes collected in Arizona, 1904. U. S. National Museum, Washington, D. C. About 70 pp. (Unpubl. manuscr.)

DISTRIBUTION, FISH, RIVER-Colorado, SURVEY

A log of activities along the Colorado and its tributaries in Arizona in 1904. Includes a list of fish collected by Chamberlain that were later identified by Robert Rush Miller, University of Michigan.

138. Chamberlain, T. K. 1946. Fishes, particularly the suckers, Catostomidae, of the Colorado River drainage and of the Arkansas River drainage, in relation to the Gunnison-Arkansas transmountain diversion. U. S. Fish and Wildlife Service, College Station, Texas. 8 pp. (Unpubl. manuscr.)

FISH, FISH-rare, MANAGEMENT, RIVER-Gunnison

Discusses the potential for competition to occur between trout and introduced suckers after reservoirs are built on the Gunnison River in Colorado. Historically, this river contained only Colorado River cutthroat trout, Salmo clarki pleuriticus. States that the Colorado squawfish or "white salmon of the Colorado" were rare in the Gunnison River by 1946. Humpback suckers were considered common and flannelmouth suckers abundant in the lower reaches of the Gunnison River.

139. Chamberlin, R. V., and D. T. Jones. 1929. A descriptive catalog of the Mollusca of Utah. Univ. Utah Biol. Ser. 1(1): 1-213.

DESCRIPTION, INVERTEBRATE

Describes the molluscs found in Utah. This catalog was later updated by (1) Woolstenhulme, J. P. 1942. New records of Mollusca. Univ. Utah, Salt Lake City, Bio. Series 6(9): 1-14; and (2) Chamberlin, R. V., and E. J. Roscoe. 1948. Checklist of recent Utah Mollusca. Univ. Utah, Salt Lake City, Biol. Series 11(1): 1-16.

140. Childress, J. 1978. The impacts of energy development on Colorado's wildlife. Proc. Annu. Conf. West. Assoc. Fish Wildl. Agencies 58: 196-201.

ENERGY, RESOURCES, WILDLIFE

Discusses the potential impacts of developing natural resources for energy on wildlife in the State of Colorado.

141. Christiansen, J. Y. 1949. Consumptive use of water studies in Colorado River area of Utah. M. S. Thesis, Utah State Univ., Logan. 75 pp.

AGRICULTURE, IRRIGATION, RIVER-Colorado

Details basic information on the consumptive use of water by standard crops in the Upper Colorado River area of Utah. Evapotranspiration tank experiments and soil-moisture studies were used to determine the amount of water consumed by agricultural crops and native vegetation. Climatological data are also given.

142. Chrostowski, H. P. 1972. Stream habitat studies on the Uinta and Ashley National Forests. U. S. Forest Service, Intermountain Region. Ogden, Utah. 149 pp.

ALTERATION, ECOLOGY, FISHERY, INVERTEBRATE, RECLAMATION, STREAMFLOW, SURVEY, WATERSHED, WATER QUALITY, WATER QUANTITY

A compilation of stream habitat studies in the Uinta and Ashley National Forests. Many water factors, such as velocity, volume, depth, and surface area, are assessed and discharge and minimum streamflows are considered in this comprehensive aquatic habitat report.

143. Chrostowski, H. P. 1976. Stream habitat and reduced flows. Pages 534-541 in J. F. Orsborn, and C. H. Allman, editors. Proceedings of a symposium and specialty conference on instream flow needs. Vol. 1. Am. Fish. Soc., Washington, D. C.

FISH, HABITAT, MANAGEMENT, RIVER-Green tributary, STREAMFLOW

Reviews methodology that combines hydraulic geometry and selected habitat characteristics for recommending winter flow releases in streams that are associated with the Central Utah Project. Provides data on Rock Creek, a tributary that flows into the Strawberry River and then into the Green River.

144. Cicchetti, C. J. 1973. Evaluating federal water projects: a critique of proposed standards. Science 181(4101): 723-728.

ECOLOGY, MANAGEMENT, RECLAMATION, WATER QUANTITY

An evaluation of standards that should be applied to federal water development.

145. Civish, W. T. 1973. Colorado River wild and scenic proposal Utah-Colorado stateline to Dolores River. U. S. Bureau of Land Management, Monticello District, Utah. 7 pp.

RECREATION, RIVER-Colorado, STREAMFLOW

General description of this river section under consideration for wild and scenic classification with a brief discussion of various resources, including vegetation, recreation, river flow and quality, land status, minerals, wildlife, livestock, and historic and prehistoric values. Current management is also discussed.

146. Clarenbaugh, F. A. 1964. Western regional planning of water resources. Water Resources Center, University of California, Berkeley. 64 pp.

MANAGEMENT, PLAN, RIVER-Colorado, WATER QUANTITY

Reviews water rights, water development, and river basin development of western waters, including information on the Colorado River.

147. Clark, M., R. D. Ingvalson, J. D. Oster, J. D. Rhoades, and J. M. Tucker. 1974. Minimizing the salt burdens of irrigation drainage waters. J. Environ. Qual. 3(4): 311-316.

IRRIGATION, RIVER-Colorado, SALINITY

Discusses ways to minimize the salinity of several rivers, including the Colorado River.

148. Clyde, C. G., D. H. Falkenborg, and J. P. Riley, editors. 1976. Colorado River Basin modeling studies. Proc. Seminar, Utah Water Res. Lab., Utah State Univ., Logan. 615 pp.

RIVER-Colorado, SALINITY, STREAMFLOW

Comprehensive review of streamflow and salinity in the Colorado River basin with emphasis on projected salinity problems in California, Colorado, Nevada, Utah, and Wyoming from future water and land use in this basin.

149. Cockerell, T. D. A. 1908. The fishes of the Rocky Mountain region. Univ. Colo. Stud. Ser. A5: 159-178.

FISH, KEYS, RIVER-Colorado and tributaries

Keys to some living and fossil fish of the Rocky Mountain region, including species found in the Colorado River drainage.

150. Cogger, W. J., M. L. Payne, and L. D. Sprenger. 1975. Water quality inventory. U. S. Environmental Protection Agency, Region VIII, Denver, Colo. 161 pp. + 67-pp. Appendix.

POLLUTION, RIVER-Colorado, SURVEY, WATER QUALITY

Survey of water quality with information on fish kills and pesticides.

151. Colborn, L. G. 1966. The limnology and cutthroat trout fishery of Trappers Lake, Colorado. Colo. Game Fish Parks Dep., Denver. Fed. Aid Proj. F-018-R Spec. Rep. 9. 26 pp.

FISHERY, LIMNOLOGY, MANAGEMENT

Relates the limnology of Trappers Lake in Garfield County, Colorado, to the cutthroat trout fishery.

152. Collotzi, A. 1976. Stream catalog for the Bridger-Teton National Forest. U. S. Forest Service, Bridger-Teton National Forest, Jackson, Wyoming. Various pagination.

DESCRIPTION, FISH, RIVER-Green and tributaries, SURVEY, WATER QUANTITY

Lists tributaries to the Green River in the Bridger-Teton National Forest, with information on the length of stream in the forest, length of stream with a fishery, classification, and species of trout present.

153. Colorado Cooperative Fishery Unit. [1968.] Annotated list of fishes native to the Colorado River Basin. Colo. Coop. Fish. Unit, Colo. State Univ., Fort Collins. 12 pp.

ABUNDANCE, DISTRIBUTION, FISH, RIVER-Colorado,

Status of the native fish fauna of the Colorado River basin (probably in late 1960's) with recommendations for research.

154. Colorado Department of Game, Fish, and Parks. 1969. Water pollution studies: study of the effects of mineral mining and milling operations on high mountain streams. Colo. Dep. Game Fish Parks, Denver. Prog. Rep., Fed. Aid Proj. F-33-R-4, Job 1.

MINERAL, POLLUTION, RIVER-Dolores, WATER QUALITY

Includes water analysis for sodium, potassium, calcium, lead, iron, molybdenum, magnesium, manganese, and copper as well as an analysis of benthos from the Dolores, San Miguel, and other rivers. Other reports for this study are available under Federal Aid Project F-33-R.

155. Colorado Department of Health. 1971. Water quality standards and stream classification. Colorado Department of Health, Water Pollution Control Commission, Denver. 30 pp.

POLICY, WATER QUALITY

Summary of water quality standards for bacteria, dissolved oxygen, pH, turbidity, and temperature in the Colorado River Basin.

156. Colorado Division of Wildlife. 1974. The strategy of today, for wildlife tomorrow. Colo. Div. Wildl., Denver. Fed. Aid Proj. FW-010-R. 46 pp.

FISH, MANAGEMENT, POLICY, WILDLIFE

Provides an analysis of the supply and demand for game and nongame species of fish and wildlife in Colorado with projections for future supply and demand.

157. Colorado Division of Wildlife. 1975. Preliminary report on endangered and threatened endemic warmwater species of fish in western Colorado rivers. Colo. Div. Wildl., Denver. Prog. Rep., Fed. Aid Proj. F-30-R-1 11. 15 pp.

DISTRIBUTION, FISH-rare, RIVER-Colorado and others, SURVEY

Preliminary report on the distribution of threatened and endangered warmwater fish in western Colorado rivers.

158. Colorado Division of Wildlife. 1975. Fish and wildlife analysis for the Dallas Creek Water Project. Colo. Dep. Nat. Resour., Div. Wildl., Denver. 225 pp.

FISH, FISH-rare, FISHERY, INVERTEBRATE, RIVER-Gunnison tributary, STREAMFLOW, SURVEY, WATER QUALITY, WILDLIFE

Detailed analysis of the fish and wildlife resources in the Dallas Creek Project area of the U.S. Bureau of Reclamation. Includes the upper reach of the Uncompaghre River, East and West Forks of Dallas Creek, Dallas Creek, Pleasant Valley Creek, and Cow Creek. Provides information on threatened and endangered fish and wildlife.

159. Colorado Legislative Council. 1965. Water pollution in Colorado. Report to the Colorado General Assembly. Colo. Legis. Counc. Resour. Publ. 105. 57 pp.

LAW, POLICY, POLLUTION, WATER QUALITY

Describes water pollution sources in the State of Colorado and discusses possible means of alleviating the problems.

160. Colorado Plateau Environmental Advisory Council. 1970-present. Monthly newsletter from September 1970 to the present. Colorado Plateau Environmental Advisory Council, P.O. Box 1389, Flagstaff, Ariz.

ALLOCATION, ECOLOGY, ECONOMICS, LAW, MANAGEMENT, POLICY, RIVER-Colorado and tributaries, STREAMFLOW, WATER QUALITY, WATER QUANTITY

Contains information on all of the key words listed and others on the Colorado Plateau, including the Colorado River Basin. Also lists completed environmental reports on this region, categorized by subject.

161. Colorado River Basin Salinity Control Forum. 1975. Water quality standards for salinity including numeric criteria and plan of implementation for salinity control: Colorado River system. Upper Colorado River Commission, Salt Lake City, Utah. 135 pp. + Appendices A-G.

RIVER-Colorado, SALINITY, WATER QUALITY

Reports the water quality standards of all seven states in a single document. Standards must be established for all interstate waters as specified in the Water Pollution Control Act Amendments of 1972, PL 92-500, Section 303. Also provides information on the past, present, and projected salinity levels of the Colorado River. Salinity control programs that may decrease salinity levels are given.

162. Colorado River Board of California. 1970. Need for controlling salinity of the Colorado River. Colorado River Board of California, Los Angeles. 89 pp.

MANAGEMENT, RIVER-Colorado, SALINITY

An appraisal of sources of salinity in the Colorado River, probable future increases in the river's salinity, deleterious impact of salinity increases on California's water users, and recommendations for controlling the river's salinity.

163. Colorado River Fishes Recovery Team. 1978. Colorado squawfish recovery plan. U. S. Dep. Inter. Fish Wildl. Serv., Area Office, Salt Lake City, Utah. 34 pp. + 34 appendices.

ABUNDANCE, DESCRIPTION, DISTRIBUTION, FISH, LIFE HISTORY, RIVER-Colorado and main tributaries

Final recovery plan for the Colorado squawfish that was prepared for review by state and federal agencies by the Colorado River Fishes Recovery Team. It provides a brief history of the abundance, distribution, and economic importance of the Colorado squawfish. It also provides an outline and narrative for a recovery plan with a 5-year budget for restoring this species to a non-endangered status.

164. Colorado River Fishes Recovery Team. 1979. Draft humpback chub recovery plan. Prepared for U. S. Fish and Wildlife Serv., Salt Lake City, Utah. 32 pp. + appendix.

ABUNDANCE, DESCRIPTION, FISH, HABITAT, MANAGEMENT, RIVER-Colorado, Green, Yampa

This draft recovery plan summarizes the literature on the humpback chub including its historical and present distribution. The major part of the draft plan outlines the research and management activities that will be required to reestablish viable populations of humpback chubs in the Colorado River. An estimated budget is provided that will be necessary to protect the continued existence of this endangered fish.

165. Colorado River Wildlife Council. 1973. Colorado River Fish disease program. Colorado River Wildlife Council, Las Vegas, Nevada. 12 pp. (Unpubl. manuscr.)

FISH, POLICY, RIVER-Colorado

Outlines the conditions, policy, definitions, and procedures for a fish disease control program for the Colorado River.

166. Colorado River Wildlife Council. 1977. Endemic fishes of the Colorado River system: a status report. Colorado River Wildl. Council, c/o W. E. Kirch (Chairman, Endemic Species Committee), Nevada Dep. Fish Game, 4747 Vegas Drive, Las Vegas, NV 89106. 15 pp.

ABUNDANCE, DISTRIBUTION, FISH, RIVER-Colorado

List of endemic fish species that are found in the Colorado River ecosystem. Includes the status of each species by state: Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming. Also provides general remarks of special interest on some species.

167. Colorado Water Conservation Board and U. S. Department of Agriculture. 1965. Water and related land resources--Colorado River Basin in Colorado. Colorado Water Conservation Board, Denver, and U. S. Forest Service and Soil Conservation Service. 183 pp.

PLAN, RIVER-Colorado, SURVEY, WATER RESOURCE

One of a series of cooperative river basin surveys on the Colorado River and its tributaries on the western slope of Colorado. These reports contain important information on the water and related land resources that was used in an overall water plan for Colorado. The reports are available for four river basins: Gunnison, 1962, 103 pp.; White, 1966, 92 pp.; Yampa, 1969, 164 pp.; San Juan, 1974, 221 pp., 13 maps.

168. Colorado Water Pollution Control Commission. 1967. Stream classification for surface waters of Colorado. Colorado Department of Public Health, Water Pollution Control Commission, Denver. Various pagination.

DESCRIPTION, LAW, POLICY, RIVER-Colorado and tributaries, WATER QUALITY

Classification of Colorado streams in compliance with the Water Quality Act of 1965 (PL 89-234). Public hearings, with about 3,300 pages of testimony, were considered in establishing the Colorado Water Quality Standards. Reviews the water laws and classifies streams by river basin.

169. Committee on Merchant Marine and Fisheries. 1973. A compilation of federal laws relating to conservation and development of our nation's fish and wildlife resources, environmental quality, and oceanography. Committee of Merchant Marine and Fisheries, U. S. Government Printing Office, Washington, D. C. 732 pp.

LAW

Compilation of federal environmental legislation; all laws in force at the time of publication dealing with wildlife conservation, fisheries, oceanography, and selected aspects of environmental quality, including Federal Water Pollution Control Act, Fish and Wildlife Coordination Act, National Environmental Policy Act, and others.

170. Connor, J. G., C. G. Mitchell, and others. 1958. A compilation of chemical quality data for ground and surface waters in Utah. U. S. Geol. Surv. Tech. Publ. 10. 276 pp.

GROUNDWATER, STREAMFLOW, WATER QUALITY, WATER QUANTITY

Summarizes all of the available information up to 1958 on the quality of groundwater and surface water in Utah.

171. Conway, M. 1975. New Mexico's endangered fishes. New Mexico Wildl. (May/June): 18-24.

DESCRIPTION, DISTRIBUTION, FISH, HABITAT, LAW

Drawings, descriptions, distributions, and other information on the endangered fish species of New Mexico are designed to keep the public aware of species depleted by alteration or destruction of habitats, loss of suitable waters, or introduction of exotics. Summarizes legislation enacted to protect and restore endangered wildlife.

172. Cook, E. P. 1952. A survey of parasites of warm-water fish from four northeastern Colorado reservoirs. M. S. Thesis, Colorado Agric. Mech. College, Fort Collins. 117 pp.

FISH, MANAGEMENT, RESERVOIR, SURVEY

Survey of parasites in largemouth bass, black crappie, black bullhead, fathead minnow, longnose sucker, and carp from reservoirs in northeastern Colorado. These parasites may also be found in species that inhabit the Colorado River.

173. Coon, K. L., Sr. 1965. Some biological observations on the channel catfish, Ictalurus punctatus (Rafinesque), in a polluted western river. M. S. Thesis, Utah State Univ., Logan. 57 pp.

ABUNDANCE, DISTRIBUTION, FISH, LIFE HISTORY, MINERAL, POLLUTION, RIVER-Dolores, SURVEY, WATER QUALITY

A study of the channel catfish in the Dolores River which was being polluted by uranium mill wastes. Aspects of the life history and general aquatic conditions were presented. The channel catfish was by far the most abundant species represented in the Dolores River at that time.

174. Cope, E. D., and H. C. Yarrow. 1875. Report upon the collections of fishes made in portions of Nevada, Utah, California, Colorado, New Mexico, and Arizona, during the years 1871, 1872, 1873, and 1874. Rep. Geogr. Geol. Explor. Surv. W. 100th Meridian (Wheeler Survey), 5(Zool.): 635-703.

DISTRIBUTION, FISH, HISTORY, RIVER-Colorado, SURVEY

An early taxonomic description of fishes of the southwestern United States including a small group considered to be most valuable--several cyprinids in the Colorado River basin.

175. Cope, O. B. 1977. Index to fishery publications of the Colorado Division of Wildlife. Colorado Div. Wildl., Div. Rep. 8 (DOW-R-D-8-77). 100 pp.

BIBLIOGRAPHY, FISH, INVERTEBRATE

A subject index of the publications of the Colorado Division of Wildlife through 1975. The index is divided into two parts: a list of publications arranged alphabetically by author and subject index by keywords. Keywords include Fish Species, Life History, Invertebrate Species, and Rivers, Streams, Creeks that are particularly useful in locating information about aquatic organisms and their location within Colorado.

176. Cordova, R. M. 1964. Hydrologic reconnaissance of part of the headwaters area of the Price River, Utah. Utah Geol. Mineral. Surv., Univ. Utah Water Resour. Bull. 4. 26 pp.

GEOLOGY, GROUNDWATER, HYDROLOGY, PRECIPITATION, RIVER-Price

Hydrogeologic investigation of 33 square miles in the Price River drainage basin in the High Plateaus section of Utah. Geologic setting, evapotranspiration, and groundwater are discussed in an attempt to determine the most efficient ways to develop the water of the area.

177. Crampton, C. G. 1952. The discovery of the Green River. Utah Hist. Q. 20(4): 299-312.

HISTORY, RIVER-Green

The Green River was explored for the first time in 1776 by the Dominguez-Escalante expedition.

178. Crandall, D. L. 1974. Management objectives in the Colorado River Basin: the problem of establishing priorities and achieving coordination. Pages 17-23 in A. B. Crawford and D. F. Peterson, eds. Environmental management of the Colorado River Basin. Utah State University Press, Logan.

MANAGEMENT, RECLAMATION, RIVER-Colorado

Concise summary of the problems involved in the coordination of agencies and establishment of priorities in management of the Colorado River.

179. Crawford, A. B., and D. F. Peterson, editors. 1974. Environmental management of the Colorado River Basin, Utah State University Press, Logan. 313 pp.

ECOLOGY, ECONOMICS, LAW, MANAGEMENT, MINERAL, POLICY, POPULATION, RECREATION, RIVER-Colorado

Proceedings of a conference in which the conferees explored the needs, conditions, and prospects for achieving a coordinated management program for the Colorado River Basin. Concerned with the legality of multiple jurisdictions by various states in planning the management strategy for the Colorado River Basin. Also concerned with influences of agriculture, energy and water development, recreation, urbanization, etc., that enter into the decision-making process.

180. Criddle, W. D. 1948. Proposed determination of water rights in Green River. Utah State Engineer, Salt Lake City. 170 pp.

LAW, POLICY, RIVER-Green, WATER QUALITY

One of six volumes summarizing water rights (and laws) that apply to the Green River.

181. Criddle, W. D. 1958. A compilation of chemical quality data for ground and surface waters in Utah. U. S. Geol. Surv. Tech. Publ. 10. 276 pp.

GROUNDWATER, HYDROLOGY, POLLUTION, RIVER-Colorado, SALINITY, SEDIMENT, WATER QUALITY

Compilation of all the available information that existed to 1958 on the quality of groundwater and surface water in Utah.

182. Criddle, W. D., K. Harris, and L. S. Willardson. 1962. Consumptive use and water requirements for Utah. Utah State Engineer, Salt Lake City, Tech. Pub. 8 (revised). 47 pp.

ALLOCATION, IRRIGATION, WATER QUANTITY

A guide to the use and requirements for water in Utah. Historically and presently, water resources have been developed and used in Utah for a single purpose -- irrigation. Irrigation return flows from one site could be used to satisfy the consumptive requirements at another site.

183. Criddle, W. D., and D. W. Jensen. 1964. Water laws of Utah and interstate compacts and treaties, 2nd ed. Utah State Engineers' Office, Salt Lake City. 167 pp.

LAW, RIVER-Colorado

Compilation of statutes governing the use of water in Utah, including provisions relative to the state agencies responsible for the administration of water. The compacts and treaties affecting Utah's interest in the Colorado River are included.

184. Cringan, A. T., and P. D. Kilburn. 1973. Environmental planning for oil shale production in western Colorado. Trans. N. Am. Wildl. Nat. Resour. Conf. 38: 445-458.

CLIMATE, ECOLOGY, GEOLOGY, HYDROLOGY, WILDLIFE

Discusses techniques of an ecological study, with particular emphasis on wildlife resources, and application to an impact analysis used in the planning of a commercial oil shale industry. Study was on a privately owned tract of 8840 acres at the headwaters of Parachute Creek, near the southern edge of the Piceance Basin northwest of Rifle (Garfield County), Colorado.

185. Crockett, E. C. 1945. The taxation of minerals in Colorado with special reference to oil shale deposits. Univ. Colorado, Eng. Exp. Stn. Bull. 2(1): 1-16.

ECONOMICS, MINERAL, RESOURCE

Reviews taxation of oil shale and other minerals in Colorado

186. Cross, J. N. 1975. Ecological distribution of the fishes of the Virgin River (Utah, Arizona, Nevada). M. S. Thesis, Univ. Nevada, Las Vegas. 187 pp.

ABUNDANCE, DISTRIBUTION, ECOLOGY, FISH, FOOD HABITS, HISTORY, WATER QUALITY

Details the distribution of native and introduced fishes in the Virgin River System of the Lower Colorado River Basin. The ecological information is pertinent to some of the fishes in the upper basin.

187. Cruff, R. W. 1975. Estimating streamflow in the Duchesne River Basin, Utah. Utah Dep. Nat. Resour. Tech. Pub. 48. 18 pp.+ plates.

HYDROLOGY, RIVER-Duchesne, STREAMFLOW

Monthly, annual, and long-term mean streamflows were estimated for streams in the Duchesne River basin on the basis of monthly measurements attempted at 44 sites in the basin during the 1971 and 1972 water years.

188. Datsen, P. 1960. Notes on diseases, parasites, food, and condition of Green River fishes, 1959. Pages 169-175 (Appendix B) in A. M. Woodbury, ed. Ecological studies of the flora and fauna of Flaming Gorge Reservoir Basin, Utah and Wyoming. Univ. Utah Anthropol. Pap. 48, Upper Colo. River Basin Ser. 3. 243 pp.

ECOLOGY, FISH, FOOD HABITS, RIVER-Green

Discusses the diseases and parasites of fishes in the Green River during summer 1959. Flannelmouth and bluehead suckers seemed to be more susceptible to diseases than other fish in the system. Industrial pollution from Green River, Wyoming, is suggested as a possible cause.

189. Davis, G. H., and L. A. Wood. 1974. Water demands for expanding energy development. U. S. Geol. Surv. Circ. 703. 14 pp.

ENERGY, WATER QUANTITY

Summarizes the consumptive demand for water in various energy processes. West of the 100th meridian, runoff is generally less than potential diversions. Therefore, energy industries must compete with other water users. Water demands for extraction of coal, oil shale, uranium, oil, and gas are modest, although large quantities of water are used in secondary recovery operations for oil.

190. Deacon, J. E. 1968. Endangered non-game fishes of the West: causes, prospects and importance. Proc. Annu. Conf. West. Assoc. State Game Fish Comm. 48: 534-549.

ABUNDANCE, ALTERATION, DISTRIBUTION, ECOLOGY, FISH-rare, HISTORY, MANAGEMENT

Summarizes the current status of the fishes occurring west of the Rocky Mountains in North America, including some found in the upper Colorado River basin. Fifty-five taxa in this area are extinct, rare, endangered, or of unknown status.

191. Deacon, J. E., and W. G. Bradley. 1972. Ecological distribution of fishes of Moapa (Muddy) River in Clark County, Nevada. Trans. Am. Fish. Soc. 101(3): 408-419.

DISTRIBUTION, ECOLOGY, FISH

Distribution of the fishes of the Moapa River, originally a tributary that entered the Virgin River a short distance from its confluence with the Colorado River. This river now enters Lake Mead. Documents the decline of the native roundtail chub (Gila robusta) that resulted from the introduction of exotic species. Offers parasitism as one mechanism for decline of this chub, since an increased incidence of parasitism occurred after establishment of exotic species. This mechanism could also be a cause for the decline of endemic species in the upper system.

192. Deacon, J. E., C. Hubbs, and B. J. Zahuranec. 1964. Some effects of introduced fishes on the native fish fauna of southern Nevada. Copeia 1964(2): 384-388.

ABUNDANCE, ALTERATION, DISTRIBUTION, FISH, FISH-rare, MOVEMENT

A number of fishes have been introduced into the depauperate fish fauna of southern Nevada. Many of the introductions have had adverse effects on local endemic species. Introduction of a cichlid and five poeciliids near Lake Mead seems to have resulted in elimination of a local race of Rhinichthys osculus; introduction of guppies at Preston endangers the resident population of Crenichthys baileyi; and introduction of goldfish at Manse Ranch threatens the remaining stock of Empetrichthys latos. Three of the introduced fishes, Cichlasoma nigrofasciatum, Lebistes reticulatus, and Mollienesia mexicana, do not seem to have been previously recorded as established in the United States.

193. Delany, R. 1966. Water for oil shale development. Denver Law J. 43(1): 72-82.

LAW, MINERAL, RIVER-Colorado, White, WATER RESOURCES

Reviews the availability of stored water and the legal problems of getting it for development of oil shale.

194. Dellenbaugh, F. S. 1908. A canyon voyage: the narrative of the second Powell Expedition down the Green-Colorado River from Wyoming, and the explorations on land, in the years 1871 and 1872. G. P. Putnam's Sons, The Knickerbocker Press, New York. 277 pp.

FISH, HISTORY, RIVER-Colorado, Green

Popular narrative describing the second Powell expedition from Green River, Wyoming, through the Grand Canyon. It contains a photograph of two Colorado squawfish and describes fishing for them during the trip. Reprinted in 1972 by the Yale Univ. Press, New Haven, Connecticut.

195. Dellenbaugh, F. S. 1965. The romance of Colorado River, 1853-1935, 2nd ed. Rio Grande Press, Chicago. 399 pp.

ARCHAEOLOGY, HISTORY, RIVER-Colorado

Story of the discovery of the Colorado River in 1540, with an account of the later explorations, and with special reference to the voyages of John Wesley Powell through the great canyons.

196. Dendy, F. E. 1968. Sedimentation in the nation's reservoirs. J. Soil Water Conserv. 23(4): 135-136.

RESERVOIR, SEDIMENT

Reviews the problem of silting and sedimentation, including sediment trap efficiency, reservoir storage, and sediment load.

197. Dewsnup, R. L. 1971. Legal protection of instream water values. U. S. Natl. Water Comm., Washington, D. C. Rep. NWC-L-71-023. 60 pp.

LAW, POLICY, WATER RESOURCE

Discusses the relation of laws on instream water values.

198. Dewsnup, R. L., and D. W. Jensen, editors. 1973. A summary-digest of state water laws. U. S. National Water Commission, Arlington, Virginia. 839 pp.

ALLOCATION, LAW, WATER RESOURCE

Discusses the development, nature, and organizational structure of state water law systems and other special subjects. A chapter is devoted to the laws of each of the 50 states.

199. Dexter, W. D. 1965. Some effects of rotenone treatment of the fauna of the Green River, Wyoming. Proc. Annu. Conf. West. Assoc. State Game Fish Comm. 45: 193-197.

ALTERATION, FISH, FISHERY, MANAGEMENT, RESERVOIR, RIVER-Green

The rotenone treatment of the river almost completely destroyed the invertebrate fauna. In the upper 10 miles of the treated area, the invertebrate population made a gradual recovery to pretreatment levels. Below that mark, the invertebrate fauna of the river was virtually nonexistent until the spring of 1963, when a small population appeared. In 1964 and 1965, fluctuations in numbers and changes in composition of the invertebrate population were noted. Except in a few backwater areas, the rotenone treatment produced nearly complete kill of fish in the entire river. Downstream, different fish species were observed after the treatment.

200. Dill, W. A. 1944. The fishery of the lower Colorado River. Calif. Fish Game 30(2): 109-211.

ABUNDANCE, ALTERATION, DISTRIBUTION, FISH, FISHERY, MANAGEMENT, RECREATION, RIVER-Colorado

Gives a detailed description of the lower Colorado River, including chemical, physical, and biological factors influencing the fishery. Gives a complete accounting of the native and the introduced fish species found in the basin, including short descriptions of abundance, distribution, food, and life history. Discusses the impact of dams and other man-related disturbances on the fishery, and concludes with recommendations for the future management of the area.

201. Dirmeyer, R. D., Jr., and M. M. Skinner. 1964. Evaluation of Colorado clays for sealing purposes. Colorado State Univ., Colorado Agric. Exp. Stn., Civil Eng. Section, Fort Collins. Tech. Bull. 83. 36 pp.

MINERAL, RIVER-Colorado, White, Yampa, SOIL

Provides information on the distribution, chemistry, and mineralogy of clays in Colorado, including the Yampa, White, and Colorado River Basins. The sealing qualities of these clays for pond bottoms were also evaluated.

202. Dixon, L. S., M. C. Teuscher, and W. Grenney. 1975. Assessment of proposed river management and planning alternatives by water quality simulation modeling. Utah Water Research Laboratory, Utah State University, Logan. 77 pp.

MANAGEMENT, MODEL, WATER QUALITY, WATER RESOURCES

Evaluates the use of water quality simulation modeling in choosing alternatives in river management.

203. Dodds, G. S. 1915. A key to the Entomostraca of Colorado. Univ. Colorado Stud. Ser. A 11: 265-298.

INVERTEBRATE, KEYS

Provides a key to the Entomostraca of Colorado.

204. Dodds, G. S. 1920. Entomostraca and life zones: A study of distribution in the Colorado Rockies. Univ. Colorado, Boulder. Biol. Bull. 39: 89-107.

ECOLOGY, INVERTEBRATE

Lists 71 species of Entomostraca and describes their distribution by life zone in Colorado. A paper by Dodds in 1917 (Proc. U. S. Nat. Museum 54: 59-87) contains similar information on altitudinal distribution of Entomostraca in Colorado.

205. Dolan, R., A. Howard, and A. Gallenson. 1974. Man's impact on the Colorado River in the Grand Canyon. Am. Sci. 62(4): 392-401.

ALTERATION, HISTORY, RECREATION, RIVER-Colorado

Reviews the history of man's alteration of the Colorado River and the effect of man on the beaches from recreational use in the Grand Canyon. The same kinds of effects are occurring from increased recreational use of rivers in the Upper Colorado River Basin.

206. Dolenc, D. A. 1967. A survey of the algae of the Green River near the town of Green River, Wyoming. M. S. Thesis, Univ. Wyoming, Laramie. 89 pp.

LIMNOLOGY, PLANKTON, RIVER-Green, SALINITY, WATER QUALITY

Lists the composition of algae (phytoplankton and periphyton) in the Green River. Also provides data on chemical and physical characteristics of the river.

207. Doll, G. F., and C. Phillips. 1972. Wyoming's hunting and fishing resources--1970. University of Wyoming, College of Commerce and Ind., Division of Business and Economic Research, Laramie. 116 pp.

ECONOMICS, FISH, MANAGEMENT, RECREATION, WILDLIFE

Detailed report of expenditures of hunters and fishermen in Wyoming. Includes information on their attitudes toward present regulations and conditions and opinions for improvement. Also includes information about landowners' attitudes toward hunting and fishing.

208. Doneen, L. D., editor. 1958. Proceedings of conference on quality of water for irrigation. Univ. Calif. Davis, Water Resour. Contrib. 14. 206 pp.

ECONOMICS, GROUNDWATER, IRRIGATION, WATER QUALITY

Emphasizes quality of water used for irrigation, and in return flows.

209. Douglas, P. A. 1952. Notes on the spawning of the humpback sucker, _Xyrauchen texanus_ (Abbott). Calif. Fish Game 38(2): 149-155.

ABUNDANCE, FISH-rare, LIFE HISTORY, RIVER-Colorado

Spawning and collecting of humpback suckers in Lake Havasu on the lower Colorado River are described.

210. Drummond, R. A. 1966. Reproduction and harvest of cutthroat trout at Trappers Lake, Colorado. Colo. Game Fish Parks Dep., Denver. Fed. Aid Proj. F-018-R and Spec. Rep. 10. 26 pp.

FISH, LIFE HISTORY, MANAGEMENT

Compares the effects of angling harvest on the reproductive potential of cutthroat trout in Trappers Lake, Garfield County, Colorado.

211. Drummond, R. A., and L. G. Colborn. 1965. Ecological study of cutthroat trout in Trappers Lake, Colorado: evaluation of cutthroat trout reproduction in the Trappers Lake inlets. Colo. Game Fish Parks Dep., Denver. Fed. Aid Proj. F-018-R-04, Job 8. 81 pp.

FISH, LIFE HISTORY, MANAGEMENT, RIVER-Colorado Basin

Evaluates reproductive success of cutthroat trout in Trappers Lake inlets and gives information on algae, zooplankton, benthos, and water chemistry for this lake (Garfield County, in the Colorado River basin).

212. Drummond, R. A., and T. D. McKinney. 1965. Predicting the recruitment of cutthroat trout fry in Trappers Lake, Colorado. Trans. Am. Fish. Soc. 94(4): 389-393.

FISH, LIFE HISTORY, MANAGEMENT, STREAMFLOW

Discusses the year-class strength and recuitment of cutthroat trout in Trappers Lake, Garfield County, Colorado.

213. Dubois, D. P. 1966. STORET II--Storage and retrieval of data from open water and land areas. U. S. Federal Water Pollution Control Administration Division of Pollution Surveillance, Washington, D. C. 25 pp.

STREAMFLOW, TEMPERATURE, WATER QUALITY

System for storage and retrieval of data on open water and land areas in the U. S. Uses "Parameter Code List for the STORET System," 3rd ed. (1966). U. S. Federal Water Pollution Control Administration, Division of Pollution Surveillance, Washington, D. C. 67 pp.

214. Dufek, D. J. 1967. Benthos: Flaming Gorge Reservoir, 1964 to 1966. Administrative Report, Wyoming Game and Fish Department, Cheyenne. 19 pp.

ABUNDANCE, DISTRIBUTION, INVERTEBRATE, RESERVOIR, RIVER-Green

Describes the abundance and distribution of invertebrates in Flaming Gorge Reservoir in 1964-66, with particular reference to a full-scale sampling program in 1966.

215. Dufek, D. J.' 1975. Lower Green River temperature study. Wyo. Game Fish Dep., Cheyenne, Admin. Rep., Proj. 4473-07-6601. 9 pp.

RIVER-Green, TEMPERATURE

Provides temperature data from 1971 to 1973 at selected stations for a 73-mile stretch of river from Fontenelle Reservoir to Flaming Gorge Reservoir.

216. Dufek, R., R. W. Wiley, B. Nielson, and J. D. Varley. 1971. Green River and Flaming Gorge Reservoir post-impoundment investigations. Joint Rep., Utah State Div. Wildl. Resour., Salt Lake City, and Wyo. Game Fish Comm., Cheyenne. Prog. Rep. 8. 31 pp.

FISH, MANAGEMENT, RIVER-Green, SURVEY

Describes a survey of the water quality, limnology, and fishery of the Green River and Flaming Gorge Reservoir in 1971.

217. Duff, D. A., and J. L. Cooper. 1976. Techniques for conducting stream habitat survey on national resource land. U. S. Dep. Inter., Bur. Land Manage., Tech. Note 283. 72 pp.

HABITAT, SURVEY

Provides an outline of procedures for conducting aquatic habitat surveys on national resource lands administered by the Bureau of Land Management. This procedure is used by the Bureau to survey streams in the Upper Colorado River Basin and elsewhere.

218. Durbrow, W. 1969. Reservoir sedimentation. Calif. Dep. Water Resour., Sacramento. Tech. Memo. 43. 17 pp.

RESERVOIR, SEDIMENT

Reviews the sediment accumulation rate in reservoirs, and reduction in reservoir capacity, and sediment-water relations .

219. Dworksy, L. B. 1962. The nation and its water resources. U. S. Department of Health, Education and Welfare, Public Health Service, Portland, Oregon. 167 pp. (Unpubl. manuscr.)

HISTORY, WATER RESOURCES

Part of a larger study on the role of the several levels of government in water resource conservation, development, and use. This manuscript is essentially a broadly based historical review (1776-1865; 1865-1900; 1900-60) of the interrelation between water and the growing nation since colonial days. Limited distribution to Public Health Service personnel.

220. Dyer, A. A. 1968. Value of a trout stream fishery. M. S. Thesis, Utah State Univ., Logan. 49 pp.

ECONOMICS, FISHERY, MANAGEMENT

Regression analysis used to compare the fishery of a stream with other competing uses.

221. Eckholm, E. 1978. Disappearing species: the social challenge. Worldwatch Institute, 1776 Massachusetts Ave. NW, Washington, D. C. Worldwatch Pap. 22. 38 pp.

ECOLOGY, SOCIOLOGY

Reviews the social challenge to save endangered species by describing the biological impoverishment that has been caused by man and outlines a strategy for setting priorities and paying the price for these priorities.

222. Ecology Consultants, Inc. 1976. Yampa Project Interim Phase D: Ecological investigations near Craig Station Site, Moffat County, Colorado. Ecology Consultants, Inc., Fort Collins, Colo., Tech. Rep. 300. 64 pp.

FISH, INVERTEBRATE, RIVER-Yampa, WATER RESOURCE

Survey providing baseline data for the aquatic resources at the Craig Station site prior to construction with emphasis on the potential for fish impingement and entrainment that will be associated with water withdrawals.

223. Ecology Consultants, Inc. 1976. Yampa Project Interim Phase D: Ecological investigations near Craig Station Site, Moffat County, Colorado. Ecology Consultants, Inc., Fort Collins, Colo., Tech. Rep. 301. 43 pp.

FISH, RIVER-Yampa

Summarizes ecological studies at the Hyden Station Site in 1975 with qualitative evaluation of fish use of the intake channel and adjacent areas of the Yampa River and a quantitative evaluation of larval fish.

224. Ecology Consultants, Inc. 1977. An indexed, annotated bibliography of the endangered and threatened fishes of the upper Colorado River system. U. S. Fish Wildl. Serv., Off. Biol. Serv., Fort Collins, Colo. FWS/OBS-77-61. 168 pp.

BIBLIOGRAPHY, FISH, FISH-rare, HABITAT, INVERTEBRATE, RIVER-Colorado

An annotated bibliography with subject, geographic, and systematic indexes, that is primarily directed to the endangered and threatened fishes of the upper Colorado River.

225. Ecology Consultants, Inc. 1978. Capture locations of rare fish in the upper Colorado River system. U. S. Fish Wildl. Serv., Off. Biol. Serv., Fort Collins, Colo. FWS/OBS-78-32. 43 pp.

DISTRIBUTION, FISH-rare, RIVER-Colorado

A series of distribution maps for rare fish found in the upper Colorado River basin based upon a survey of the literature. Maps are provided for Colorado cutthroat trout, bonytail chub, Colorado squawfish, humpback chub, humpback sucker, and the Kendall Warm Springs dace in Colorado, New Mexico, Utah, and Wyoming.

226. Eddy, R. M. 1975. The effect of point source discharges on the diversity of benthic invertebrates of the Yampa River, Steamboat Springs to Hayden, Colorado - September, 1975. U. S. Environ. Protect. Agency, Denver, Colo. SA/TIB-30. 43 pp.

INVERTEBRATE, RIVER-Yampa, WATER QUALITY

Macroinvertebrates were sampled at 17 locations (3 samples each) along a 61-km reach of the Yampa River with modified Surber samplers in September 1975 to determine the impact of known point-source discharges on these organisms.

227. Eddy, S. 1957. How to know the freshwater fishes. Wm. C. Brown Co., Dubuque, Iowa. 253 pp.

DESCRIPTION, DISTRIBUTION, FISH, KEYS

Comprehensive list of the freshwater fish of the United States with a key to their identification.

228. Edmondson, C. H. 1912. Protozoa of high mountain lakes in Colorado. Univ. Colo. Stud. Ser. A, 9: 65-74.

DISTRIBUTION, INVERTEBRATE

Lists species of aquatic Protozoa for a number of mountain lakes between 8,875 and 12,740 feet in elevation.

229. Edmunds, G. F., Jr., R. K. Allen, and W. L. Peters. 1963. An annotated key to the nymphs of the families and subfamilies of mayflies (Ephemeroptera). Univ. Utah (Salt Lake City) Biol. Ser. 13(1): 1-56.

INSECT, KEYS

Keys for nymphs of mayflies in Utah. This series also contains the following papers: G. F. Edmunds, and G. G. Musser, "The mayfly fauna of Green River in the Flaming Gorge Reservoir Basin, Wyoming and Utah," pp. 112-123; R. J. Musser, "Dragonflies (Odonata: Anisertera) from Green River in the Flaming Gorge Reservoir Basin, Wyoming and Utah," pp. 126-132; and J. Sessions and A. R. Gaufin, "Stoneflies (Plecoptera) from Green River in the Flaming Gorge Reservoir Basin, Wyoming and Utah," pp. 134-137.

230. Ehrenfeld, D. W. 1976. The conservation of non-resources. Am. Sci. 64: 648-656.

ECOLOGY, ECONOMICS, PLAN, WILDLIFE

Discussion of the rationale for the preservation of endangered species. Economic and even ecological justifications for the preservation of endangered species may weaken the conservation position in unpredictable ways. Non-resource reasons are ultimately more significant.

231. Eiserman, F., editor. 1958. A fisheries survey of the Little Snake River drainage. Wyoming Game Fish Dep., Cheyenne. Fish Tech. Rep. 6. 35 pp + appendix.

ABUNDANCE, DISTRIBUTION, FISH, FISH-rare, FISHERY, HABITAT, MANAGEMENT, RIVER-Little Snake, WATER QUALITY

Analyzes the sport fishery potential of all tributaries to the Little Snake River in Wyoming. Many of these streams contain the Colorado River cutthroat trout (Salmo clarki pleuriticus). Also discusses the fish population, available habitat, food supply, and water quality of each stream and offers management options for each stream.

232. Elliott, R. D., J. F. Hannaford, and R. W. Shaffer. 1973. Twelve basin investigation analysis of potential increases in streamflow resulting from modification of cold orographic clouds in selected river basins of the western United States. Natl. Tech. Inf. Serv., Springfield, Va. PB-232 132. 328 pp.

CLOUD SEEDING, RIVER-Colorado, STREAMFLOW, WEATHER

Presents the cloud seeding potential for increased streamflow from seven major river basins in the western United States, including the upper Colorado. Potential incremental streamflow was computed for the water years 1951-52 through 1970-71.

233. Ellis, M. M. 1914. Fishes of Colorado. Univ. Colo. (Boulder) Stud. 11(1): 1-135.

ABUNDANCE, DESCRIPTION, DISTRIBUTION, FISH, HISTORY, LIFE HISTORY

A description of the fish found in Colorado in 1914.

234. Ellis, M. M. 1915. Fishes of Colorado. Univ. Colo. (Boulder) Stud. Ser. A 11: 5-140.

DESCRIPTION, ECOLOGY, FISH, KEYS, RIVER-Colorado and tributaries

Describes the fish found in Colorado and their ecology and distribution. Data on museum specimens and keys. The squawfish occurs in Colorado only in the Grand, White, and Yampa Rivers and their tributaries. Because of its large size it is a valuable food fish. Humpback sucker is generally distributed throughout the Colorado River drainage in the large streams below the foothill region. Because of their large size, adult humpback suckers are often marketed with flannelmouth suckers. The humpback sucker was taken in considerable numbers by the Mohave Indians from the Colorado River near Fort Mohave.

235. Ellis, W. H. 1966. Watercourses--recreational uses for water under prior appropriation law. Nat. Resour. J. 6(2): 181-185.

FISH, LAW, RIVER-Colorado

Reviews legal considerations regarding the recreational use of water. Points out that a 1937 act empowered the Colorado River Water Conservation District to maintain streamflow for fish life.

236. Emrich, S. L., and E. Painter. 1978. A field inventory of candidate threatened and endangered plants of the Piceance Basin including adjacent areas and a floristic survey at Cross Mountain Canyon. The Natural Areas Program, Colorado Dep. Nat. Resour., Denver, and Office of Endangered Species, U.S. Fish Wildl. Serv., Denver, Colo. 27 pp. + 10 appendices.

VEGETATION

Survey of proposed endangered plant species in western Colorado, primarily in Rio Blanco and Garfield Counties. Also provides a checklist of vascular plants in the Cross Mountain Canyon through which the Yampa River flows.

237. Energy Policy Project. 1974. Exploring energy choices. The Ford Foundation, Washington, D. C. 81 pp.

ECOLOGY, ENERGY, MANAGEMENT, POLICY, RESOURCES

Summarizes the energy problems facing our nation as a result of a long history of neglect and oversight. Provides various scenarios that offer choices in three policy areas.

238. Enviro Control, Inc. 1976. Assessment of effects of altered streamflow characteristics on fish and wildlife. Final Rep., U. S. Fish Wildl. Serv. Contract No. 14-16-0008-956. Enviro Control, Inc., 11300 Rockville Pike, Rockville, Maryland. Executive summary 14 pp.
Volume II: Rocky Mountain case studies. 373 pp.
Task 3: Analysis of case study findings, identification of problems, and recommendation of remedies. 120 pp.

FISH, MANAGEMENT, RECLAMATION, RIVER-Colorado, STREAMFLOW, WATER QUALITY, WILDLIFE

Evaluation of streamflow methodologies and the associated recommendation process to preserve fish and wildlife through instream flow reservations. It contains data to assess the actual impacts on fish and wildlife of streamflow regulation by Grandby, Shadow Mountain, and Willow Creek Dams (Bureau of Reclamation Colorado-Big Thompson Project) on the Colorado River.

239. Eustis, A. B., and H. H. Hillen. 1954. Stream sediment removal by controlled reservoir releases. Prog. Fish-Cult. 16(1): 30-35.

RESERVOIR, RIVER-Colorado, SEDIMENT, STREAMFLOW

The accumulation of sediment in the Colorado River below Granby Dam was removed by flushing in a Bureau of Reclamation project designed to preserve river productivity. The flushing operation achieved a substantial degree of success in restoring habitat conditions that were favorable to organisms which serve as food for trout.

240. Evans, L., and B. Belknap. 1973. Dinosaur river guide. Westwater Books, Boulder City, Nev. 64 pp.

DESCRIPTION, HISTORY, RECREATION, RIVER-Green, Yampa

Provides maps with river distances and a description of the Green and Yampa Rivers in the vicinity of Dinosaur National Monument; also historical information about the region, with numerous sketches and photographs.

241. Evans, L., and B. Belknap. 1974. Desolation river guide. Westwater Books, Boulder City, Nev. 56 pp.

DESCRIPTION, HISTORY, RECREATION, RIVER-Green

Provides maps with river distances and a description of the Green River in Desolation Canyon, and historical information about the region, with numerous sketches and photographs.

242. Everett, A. G. 1970. Comprehensive water resources management: the past and the future. Water Resour. Bull. 7(1): 185-188.

MANAGEMENT, POLICY, WATER QUANTITY

Stresses that water resources planning requires inter-agency cooperation, and emphasizes the planning and political aspects of the comprehensive management of water.

243. Everhart, W. H., and R. M. Duchrow. 1970. Effects of suspended sediment on aquatic environment. U. S. Bur. Reclam., Denver. Colo. Final Rep., Contract 14-06-D-6596. 116 pp.

FISH, INVERTEBRATE, SEDIMENT, WATER QUALITY

Study of the effects of sediment on fish and invertebrates.

244. Everhart, W. H., and B. E. May. 1973. Biota and chemistry of Piceance Creek. Vol. 1. Effects of chemical variations in aquatic environment. U. S. Environ. Protect. Agency, Washington, D. C. Ecol. Res. Serv., EPA-R3-73-011a. 129 pp.

ECOLOGY, INSECT, INVERTEBRATE, LIMNOLOGY, MINERAL, PLANKTON, POLLUTION, WATER QUALITY

Summary of the physical, chemical, and biological factors in Piceance Creek, a tributary to the White River in Colorado. This area contains rich deposits of oil shale.

245. Everhart, W. H., and W. R. Seaman. 1971. Fishes of Colorado. Colorado Game, Fish, and Parks Division, Denver. 75 pp.

FISH, KEYS, RIVER-Colorado and tributaries

Keys for identification, as well as descriptions and information on life histories.

246. Evermann, B. W., and C. Rutter. 1895. Fishes of the Colorado Basin. U. S. Fish Comm. Bull. 14(1894): 473-486.

BIBLIOGRAPHY, DISTRIBUTION, FISH, RIVER-Colorado

Summarizes the accessible literature on fish collections in the Colorado River and fish distribution as of 1894.

247. Evermann, R. W., and H. W. Clark. 1931. A distribution list of the species of freshwater fishes known to occur in California. Calif. Fish Game Dep. Fish Bull. 35. 67 pp.

ABUNDANCE, BIBLIOGRAPHY, DISTRIBUTION, FISH

Compilation of abundance and distribution of the freshwater fish from definite localities in California.

248. Fahey, J. J. 1962. Saline minerals of the Green River Formation. U. S. Geol. Surv. Prof. Paper. 405. 50 pp.

MINERAL, SALINITY

Occurrence and properties of various saline minerals found in this rock formation.

249. Fairchild, W. D. 1974. Water development--better planning. Trans. N. Am. Wildl. Nat. Resour. Conf. 39: 20-27.

PLAN, RECLAMATION, WATER QUANTITY

Emphasizes that better planning is needed for effective water resource development.

250. Farquhar, F. D. 1953. The books of the Colorado River and the Grand Canyon; a selective bibliography. Glen Dawson, Los Angeles. 75 pp.

BIBLIOGRAPHY, HISTORY, RIVER-Colorado

Bibliography, emphasizing historical works, on the following selected subjects: I. The Sixteenth, Seventeenth, and Eighteenth Century. II. The Early Nineteenth Century. III. The Mormons on the Colorado. IV. Down the River and Through the Canyon. V. The Grand Canyon Appreciated. VI. Geologic Studies. VII. The Lower River and the Salton Sea. VIII. Dams and Development. IX. Miscellaneous.

251. Farringer, R. T., III., A. A. Echelle, and S. F. Lehtinen. 1979. Reproductive cycle of the red shiner, *Notropis lutrensis*, in Central Texas and south central Oklahoma. Trans. Am. Fish. Soc. 108(3): 271-276.

FISH, HABITAT, LIFE HISTORY

Summarizes information on reproduction of the red shiner. Length frequency distributions of fry suggest two discrete periods of maximum spawning activity during two years. Some individuals survive through two winters and spawn in two successive years. References on other phases of the life history are also provided. This species has become well established in the Colorado River with large populations in some reaches.

252. Feast, C. N., Jr., 1938. A preliminary study of the proposed whitefish transplanting in Western Colorado waters. U. S. Forest Service, Denver, Colo. 15 pp. + appendix.

FISH, MANAGEMENT, RIVER-Colorado, White and tributaries

Sportsmen requested the transplant of mountain whitefish from the White River to the upper reaches of the Colorado River, primarily to the Roaring Fork and Eagle Rivers. The author evaluated the feasibility of such transplants, suggested that the life history of the species be studied, and recommended formulation of management plans for the increasing winter fishery in the White River.

253. Feast, C. N. 1954. Project Report: Grand Lake, Shadow Mountain Reservoir and Granby Reservoir Fish Management Investigations. Colorado Department of Game and Fish, Fish Management Division, Denver. 24 pp.

FISHERY, MANAGEMENT, RIVER-Colorado

Creel census, stocking, rough fish control, limnology, food and tagging studies.

254. Federal Water Pollution Control Administration. 1966. Frequency analysis of specific water quality parameters for the Colorado River Basin. U. S. Federal Water Pollution Control Administration, Southwest Region, San Francisco, Calif. 48 pp. + 514 pp. appendix.

RIVER-Colorado, WATER QUALITY

Analysis of water quality in the Colorado River basin.

255. Federal Water Pollution Control Administration. 1967. Briefing document on uranium mill tailings. U. S. Federal Water Pollution Control Administration, Colorado River Basin Water Quality Project, Southwest Region, San Francisco, Calif. Various pagination.

MINERAL, POLLUTION, RIVER-Colorado and tributaries, WATER QUALITY

Extensive coverage by briefs on uranium mill tailings, prepared for 68th session of the conference on the matter of pollution of the Interstate Waters of the Colorado River and its tributaries, Denver, Colorado.

256. Federal Water Pollution Control Administration. 1967. Immediate water pollution control needs for the interstate waters in the Colorado River Basin: Wyoming, Colorado, Utah, New Mexico, Nevada, Arizona, and California. U. S. Federal Water Pollution Control Administration, Southwest Region, San Francisco, Calif. 59 pp.

POLLUTION, RIVER-Colorado

Focuses attention on known sources of pollution that affect water uses or the aesthetic environment in the Colorado River basin.

257. Federal Water Pollution Control Administration. 1967. River Basin simulation program. U. S. Federal Water Pollution Control Administration, Comprehensive Planning and Programs, Washington, D. C. 22 pp. + 2 appendices.

MODEL, WATERSHED

Simulation model to predict water supply and streamflow by river basin or watershed.

258. Federal Water Pollution Control Administration. 1968. A report on biological studies of selected reaches and tributaries of the Colorado River. U. S. Federal Water Pollution Control Administration, Cincinnati, Ohio. 166 pp.

DISTRIBUTION, FISH, INVERTEBRATE, PLANKTON, RIVER-Colorado, Dolores, San Juan, WATER QUALITY

This study was made to determine the effects of municipal and industrial wastes on aquatic life in selected waters of the Colorado River basin. The habitat for aquatic life was highly varied because of extreme differences in water quality caused by pollutants from mineral mining operations, municipalities, oil refineries, natural mineral springs, runoff, mine drainage, and irrigation return waters.

259. Federal Water Pollution Control Administration. 1968. Water quality control study Uinta Unit, Central Utah Project, Uinta River Basin, Utah. U. S. Federal Water Pollution Control Administration, Southwest Region, San Francisco, Calif. 41 pp. + appendix.

POLLUTION, RIVER-Green, SALINITY, WATER QUALITY

Concluded that control of salinity was needed in the Uinta River, Utah, because water quality would be affected downstream.

260. Federal Water Pollution Control Administration. 1969. Pollution of the Upper Colorado River Basin. U. S. Federal Water Pollution Control Administration, Cincinnati, Ohio. 21 pp. + appendix. Tables A-1 to A-22.

MINERAL, POLLUTION, RIVER-Colorado, Gunnison, San Juan, WATER QUALITY

Objective was to obtain background information for planning and projection by the Colorado River Basin Water Control Project. Contains information on water uses, waste sources, dissolved oxygen, metals, total dissolved solids, and other factors.

261. Federal Water Pollution Control Administration. 1969-1971. Water quality evaluation. U.S. Federal Water Pollution Control Administration, Pacific Southwest Region, San Francisco, Calif.
1969. Bluestone Project, Colorado. 16 pp.
1971. Savery-Pot Hook Project. 12 pp.
1971. Grand Mesa Project. 16 pp.

RIVER-Colorado, Little Snake, WATER QUALITY

Evaluates water quality in the Colorado and Little Snake Rivers related to Bureau of Reclamation projects.

262. Federal Water Pollution Control Administration. 1970. Radium monitoring network. U. S. Federal Water Pollution Control Administration, Colorado River Basin Water Quality Control Project, Denver. Data release 16. 7 pp. + appendix.

MINERAL, POLLUTION, RIVER-Colorado, Dolores, Gunnison, San Juan, WATER QUALITY

The Radium Monitoring Network is a surface water surveillance system consisting of 19 sampling stations located on various streams in the Upper Colorado River system. Fifteen releases were issued previously from October 1962 through July 1969. Others to be issued as supplements.

263. Federal Water Pollution Control Administration and Bureau of Reclamation, Region 4. 1970. Cooperative salinity control reconnaissance study--upper Colorado River Basin. U.S. Federal Water Pollution Control Administration, Southwest Region, San Francisco, Calif., and U. S. Bur. Reclam., Region 4, Salt Lake City, Utah. 119 pp.

MANAGEMENT, RIVER-Colorado, SALINITY, SURVEY

Survey of Upper Colorado River to determine ways to control salinity.

264. Federal Water Quality Administration. 1970. Clean water for the 1970's--a status report. U. S. Federal Water Quality Administration, Washington, D. C. 78 pp.

POLLUTION, WATER QUALITY

General report on water quality that reviews federal and state water pollution control programs and assesses measures necessary to provide water of suitable quality for the United States. The first annual progress report on this subject.

265. Fellows, A. L. 1902. Water resources of the State of Colorado. U. S. Geol. Surv. Water-Supply Pap. 74. 151 pp.

IRRIGATION, RIVER-Colorado, Dolores, Green, Gunnison, San Juan, RUNOFF, WATER QUANTITY

Description of water resources in several rivers of Colorado.

266. Feltis, R. D. 1966. Water from bedrocks in the Colorado Plateau of Utah. Utah State Engineer, Salt Lake City, Tech. Publ. 15. 82 pp.

DESCRIPTION, RIVER-Colorado, Green and tributaries, WATER QUANTITY

The bedrock aquifers in the Colorado Plateau of Utah yield water that varies widely in chemical quality and yield. Dissolved solids in 649 samples from 534 sites ranged from less than 100 to more than 390,000 ppm. Water yield varied from 1 to 54,000 barrels per day from wells and from less than 1 to 4,100,000 barrels per day from springs.

267. Feltis, R. D. 1968. Preliminary assessment of groundwater in the Green River Formation. U. S. Geol. Surv. Prof. Pap. 600. 235 pp.

GEOLOGY, GROUNDWATER, RIVER-Duchesne, Green

The Green River Formation of the Eocene contains not only large reserves of hydrocarbons in the form of bituminous sand and oil shale, but also aquifers that supply varying quantities of water to wells and springs and later to the Green River. The groundwater quality varies from fresh to highly saline.

268. Fields, F. K. 1975. Streamflow characteristics in northeastern Utah and adjacent areas. U. S. Geol. Surv., Utah Basic-Data Release 25. 190 pp.

RIVER-Green, STREAMFLOW

Contains statistical summaries of streamflow records from 74 gauging stations in northeastern Utah that drain primarily into the Green River.

269. Finnell, L. M. 1961-63. Granby Reservoir fish management studies. Colo. Dep. Game Fish, Denver. Job Progress Rep. 1961-62 (1 vol.), 27 pp.; 1963, 17 pp.

FISH, FISHERY, LIMNOLOGY, RIVER-Colorado

Summary of fish distribution, limnological conditions, and creel census of the fishery.

270. Finnell, L. M., G. L. Bennett, J. Griest, and R. Gregg. 1975. Fryingpan Arkansas fish research investigations. Colo. Div. Wildl., Proj. Rep. 4. 23 pp.

DISTRIBUTION, FISH, FISH-rare, INVERTEBRATE, RIVER-Colorado

This report and others published in 1970, 1972, 1973, and 1974 (See Cope 1977) provide information on the limnology, macroinvertebrates, and fish populations in the upper Arkansas River and Fryingpan River drainages. The Colorado River cutthroat trout (Salmo clarki pleuriticus), a rare fish, is found in the Fryingpan River drainage.

271. Fitzsimmons, S. J., and O. A. Salamon. 1973. A social report--man and water. Abt. Association, Inc., 55 Wheeler St., Cambridge, Mass. 428 pp.

MANAGEMENT, PLAN, SOCIOLOGY, WATER QUANTITY

A comprehensive report prepared on contract for the U. S. Department of the Interior, Bureau of Reclamation, Denver, Colorado, that summarizes the relation between social-psychological systems and water resources development.

272. Fletcher, H. C., and H. B. Elmendorf. 1955. Phreatophytes--a serious problem in the West. U. S. Dep. Agric. Yearb. 1955: 423-429.

MANAGEMENT, VEGETATION, WATER QUANTITY

Summarizes the problem of phreatophytes as related to water supply and management in the West.

273. Fletcher, K., and M. F. Baldwin, editors. 1973. A scientific and policy review of the final environmental impact statement for the prototype oil shale leasing program of the Department of the Interior. Environmental Impact Assessment Project, Institute of Ecology, Washington, D. C. 197 pp.

MANAGEMENT, POLICY, RESOURCE, RIVER-Green, White

Examines program design, alternatives, environmental impacts, public participation, and legal aspects of the prototype oil shale leasing program of the U. S. Department of the Interior. Includes a critique by disciplines on the physical, biological, and social impacts and provides recommendations to the Department of the Interior to assist it in making decisions.

274. Flowers, S. Undated. The algae of Utah. Univ. Utah, Dep. Bot., Salt Lake City. 70 pp. (Unpubl. pam.)

KEYS, LIMNOLOGY

Describes the algae found in the State of Utah, including some found in the Colorado River System.

275. Flowers, S., editor. 1960. Ecological studies of the flora and fauna of Flaming Gorge Reservoir Basin, Utah and Wyoming. Univ. Utah, Dep. Anthropol., Anthropol. Pap. 48 (Upper Colo. Ser. 3). 251 pp.

DISTRIBUTION, FISH, INVERTEBRATE, LIMNOLOGY, RIVER-Green, VEGETATION

Contains several reports on the invertebrates, fish species, arthropods, and terrestrial vegetation in the section of Green River that was impounded by Flaming Gorge Reservoir.

276. Flowers, S. 1963. Study of non-vascular plants of Dinosaur National Monument. Univ. Utah, Salt Lake City, Misc. Pap. 1. 8 pp.

VEGETATION

Provides a list of algae and bryophytes as well as a description of the habitats of these plants in Dinosaur National Monument that were found during July and August 1963.

277. Follansbee, R. 1929. Upper Colorado River and its utilization. U. S. Geol. Surv. Water-Supply Pap. 617. 394 pp. + map.

HISTORY, POWER, RESERVOIR, RIVER-Colorado, WATER QUALITY, WATER QUANTITY

One of a series of reports treating the value and use of the Colorado River for reservoirs and power dams.

278. Follett, W. I. 1960. The fresh-water fishes - their origins and affinities. In symposium: The biogeography of Baja California and Adjacent seas. Systematic Zool. 9: 212-232.

ABUNDANCE, DISTRIBUTION, FISH, RIVER-Colorado

Past and recent status of fish inhabiting Baja California including those found in the Colorado River.

279. Ford, C. R. 1975. Effect of new legislation on management of river systems. Trans. N. Am. Wildl. Nat. Resour. Conf. 40: 273-280.

LAW, MANAGEMENT, WATER QUALITY, WATER QUANTITY

Brief summaries of portions of federal acts that apply to the intelligent management of floodplains, floodwaters, pollutants, and new urban development on river systems.

280. Fowler, D. D., R. C. Euler, and C. S. Fowler. 1969. John Wesley Powell and the anthropology of the Canyon Country. U. S. Geol. Surv. Prof. Pap. 670. 30 pp.

ARCHAEOLOGY, HISTORY

Description of John Wesley Powell's anthropological field work, the archaeology of the Canyon Country, and Powell's notes on the origins, customs, practices and beliefs of the Indians of that area.

281. Frank, E. C. 1973. Snow amount in relation to streamflow and herbage production in Colorado. J. Range Manage. 26: 32-34.

PRECIPITATION, STREAMFLOW, VEGETATION

Relates snowpack to streamflow and vegetation in Colorado.

282. Frank, E. C., H. E. Brown, and J. R. Thompson. 1975. Hydrology of Black Mesa watersheds, Western Colorado. U. S. For. Serv., Gen. Tech. Rep. RM-13. 11 pp.

GEOLOGY, GRAZING, HYDROLOGY, RUNOFF, SEDIMENT, SOIL, WATERSHED

The relation between runoff and suspended sediment to bare soil caused by grazing was studied for 11 years. Grazing in this area removed an average of 40% of the grass production.

283. Frankel, O. H. 1974. Genetic conservation: our evolutionary responsibility. Genetics 78 (1): 53-65.

ECOLOGY, GENETICS, WILDLIFE

Discusses a rationale for preserving rare species.

284. Franklin, D. R. 1963. Green River, Utah and Colorado. U. S. Fish and Wildlife Service, Albuquerque, N. M. 6 pp. (Unpubl. manuscr.)

FISHERY, MANAGEMENT, RIVER-Green, SURVEY

Sampling study to determine numbers and kinds of fish on the Green River in Colorado and Utah in 1963. The object of the work was to obtain samples which could be compared with samples collected in 1961 and 1962. The single type of gear used--a bank shocker-- was decidedly inadequate.

285. Frary, L. G. 1954. Waterfowl production in the White River Plateau, Colorado. M. S. Thesis, Colorado State Univ., Fort Collins. 93 pp.

RIVER-White, WILDLIFE

Study of waterfowl produced in the White River.

286. Fraser, J. C. 1972. Regulated stream discharge for fish and other aquatic resources--an annotated bibliography. FAO Fish. Tech. Pap. 112. 103 pp.

BIBLIOGRAPHY, FISH, INVERTEBRATE, STREAMFLOW

Review of the available world literature, with annotations dealing with the effects of acceptable water quantity or streamflow on fish and other aquatic resources.

287. Fraser, J. C. 1972. Water levels, fluctuations, and minimum pools in reservoirs for fish and other aquatic resources: an annotated bibliography. FAO Fish. Tech. Pap. 113. 42 pp.

BIBLIOGRAPHY, FISH, INVERTEBRATE, RESERVOIR, WATER QUANTITY

Review of the available world literature, with annotations dealing with the effects of fluctuation and pool levels on fish and other aquatic resources.

288. Freeman, L. R. 1923. The Colorado River: yesterday, today and tomorrow. Dodd, Mead and Co., New York. 451 pp.

HISTORY, RIVER-Colorado

General review of the past, present, and future history of the Colorado River.

289. Friedkin, J. F. 1972. The Colorado River: international aspects. Nat. Resour. J. 12(4): 515-519.

LAW, RIVER-Colorado, WATER QUALITY, WATER QUANTITY

Reviews the international implications of water quality and supply of the Colorado River as related to the water treaty between the United States and Mexico.

290. Frost, H. H., J. R. Murphy, J. H. Wing, and S. S. Taba. 1964. Limnological studies of the Colorado River in the vicinity of Moab, Utah. Dep. Zool. Chem., Brigham Young Univ., Provo, Utah. Prog. Rep. 2. 34 pp.

FISH-rare, LIMNOLOGY, RIVER-Colorado, SURVEY, WATER QUALITY

Provides a 2-year survey (November 1961 - November 1963) of limnological conditions in a reach of the Colorado River that could be affected by potash production. Primary production was low because of turbidity and shifting substrate; the basis of energy in the ecosystem was considered to be detritus. Rare fish in this reach of the river included the Colorado squawfish, humpback sucker, and bonytail chub.

291. Funk, W. H. 1966. Phytoplankton productivity of a newly developed reservoir. Ph.D. Thesis, Univ. Utah, Salt Lake City. 224 pp.

LIMNOLOGY, RESERVOIR, RIVER-Green

Limnological investigation of Lake Viva Naughton near Kemmerer, Wyoming, which flows into the Green River. No mineral could be established as a major limiting factor. Auto-inhibition by the extracellular products of the algae themselves probably represents the main factor limiting growth.

292. Funk, W. H., and A. R. Gaufin. 1971. Phytoplankton productivity in a Wyoming Cooling-Water Reservoir. Pages 167-178 in G. E. Hall, ed. Reservoir fisheries and limnology. Am. Fish. Soc., Spec. Publ. 8.

ABUNDANCE, DISTRIBUTION, LIMNOLOGY, PLANKTON, RESERVOIR, RIVER-Green

Describes the response of plankton during and shortly after impoundment of Lake Viva Naughton near Kemmerer, Wyoming, on the Ham's Fork River, a tributary to the Green River.

293. Gagnon, J. 1974. Greenback cutthroat trout--museum pieces won't do. Natl. Parks Conserv. Mag. 48(10): 21-23.

ABUNDANCE, DISTRIBUTION, FISH-rare, MANAGEMENT

Popular article dealing with the decline of the greenback cutthroat trout in Colorado and attempts to save it from extinction.

294. Gard, R., and R. L. Bottorff. 1974. Review of the literature concerning animals and plants in the Grand Valley and Glenwood - Dotsero areas of Colorado. U. S. Bur. Reclam., Grand Junction, Colo. 102 pp.

BIBLIOGRAPHY, VEGETATION, WILDLIFE

Literature review on plants and animals in the Grand Valley area of Colorado.

295. Garstka, W. U. 1958. Evaporation control of large reservoirs: a bibliography. U. S. Bur. Reclam., Denver, Colo. 4 pp. (Unpubl. Manuscr.)

BIBLIOGRAPHY, RECLAMATION, RESERVOIR

Bibliography of techniques to control loss of water due to evaporation in reservoirs.

296. Garstka, W. U., L. D. Love, B. C. Goodell, and F. A. Bertle. 1958. Factors affecting snowmelt and streamflow, Fraser Experimental Forest, 1946-53. U. S. Bur. Reclam, and U. S. Forest Serv., Fort Collins, Colo. 189 pp.

PRECIPITATION, STREAMFLOW, WATER QUANTITY

Summarizes data collected at the Fraser Experimental Forest, Fraser, Colorado, during 1947-53. Relations are developed between daily snowmelt hydrograph and the melt-causing meteorological factors that lead to the development of techniques for forecasting daily the shape of the snowmelt hydrograph. The relation of area of snow cover to the resulting hydrograph is given for the year when detailed mapping of the snow-covered area was made.

297. Gaufin, A. R. 1957. Limnological analyses of Jordan, Price, Provo, and Weber Rivers. Dep. Zool., Univ. Utah, Salt Lake City. 7 pp. + tables and maps.

HYDROLOGY, LIMNOLOGY, RIVER-Price, TEMPERATURE, WATER QUALITY

Water quality data from the Price River and others not in the Colorado Basin. Includes dissolved oxygen, percentage saturation, CO_2, pH, biological oxygen demand, and others. Report to Utah State Water Pollution Control Board.

298. Gaufin, A. R. 1958. Report on limnological and sanitary characteristics of Jordan, Price, Provo, and Weber Rivers for 1957-58. Dep. Zool., Univ. Utah, Salt Lake City. 7 pp. + tables.

HYDROLOGY, LIMNOLOGY, RIVER-Price, TEMPERATURE, WATER QUALITY

Water quality data from the Price River and others not in the Colorado Basin. Includes dissolved oxygen, percentage saturation, CO_2, pH, biological oxygen demand, and others. Report to the Utah State Water Pollution Control Board.

299. Gaufin, A. R., A. V. Nebeker, and J. Sessions. 1966. The stoneflies (Plecoptera) of Utah. Univ. Utah, Salt Lake City, Biol Ser. 14(1): 1-93.

DISTRIBUTION, INSECT, KEYS, LIFE HISTORY

Provides keys, distribution, geographic range, and biology of stoneflies found in Utah.

300. Gaufin, A. R., G. R. Smith, and P. Dotson. 1960. Aquatic survey of the Green River and tributaries within the Flaming Gorge Reservoir basin, Appendix A. Pages 139-162 in A. M. Woodbury, ed. Ecological studies of the flora and fauna of Flaming Gorge Reservoir basin, Utah and Wyoming. Univ. Utah Anthropol. Pap. 48. Upper Colo. River Basin, Ser. 3. 243 pp.

DISTRIBUTION, FISH, INVERTEBRATE, LIMNOLOGY, RIVER-Green, WATER QUALITY

Results of a survey conducted on the Green River and some tributaries in the Flaming Gorge Reservoir Basin during the summer of 1959. This survey included physical and chemical data, and collection of fishes, insects, and algae taken at selected locations in the Green River.

301. Gessel, G. D. 1975. Sediment storage and measurement in the Upper Colorado River Basin. Proc. 2nd Inter-Agency Sedimentation Conf., U. S. Dep. Agric. Misc. Publ. 970: 778-784.

RIVER-Colorado, SEDIMENT

Summarized sediment measurement, storage, and transport in the Upper Colorado River Basin.

302. Giefer, G. J. 1976. Sources of information in water resources: an annotated guide to printed materials. Water Resources Center Archives, Univ. California, Berkeley. 210 pp.

BIBLIOGRAPHY, WATER RESOURCES

Contains over 1100 annotated references in the water resources field covering such topics as water supply, water quality, management, engineering, and water resources planning. Includes directories, indexes, glossaries, and abstract journals.

303. Gifford, G. F., R. H. Hawkins, J. J. Jurinak, S. L. Ponce, and J. P. Riley. 1975. Effects of land processes on diffuse sources of salinity in the Upper Colorado River Basin. Annual Report Utah Agric. Exp. Stn., Utah State Univ., Logan. 45 pp.

EROSION, MINERAL, SALINITY, SOIL, WATER QUALITY

Progress report of research on diffuse resources of salinity to the Price River, a tributary of the Green River. Discusses local geology and gives soil analyses for the area. Certain plant species were believed to be potential contributors to the total salt load in overland flow.

304. Gilbert, C. H., and N. B. Scofield. 1898. Notes on a collection of fishes from the Colorado Basin in Arizona. Proc. U. S. Natl. Mus. 20: 487-499.

DISTRIBUTION, FISH, HISTORY, RIVER-Colorado, SURVEY

A report of native fish species observed during a survey of the lower Colorado River in the spring of 1890.

305. Girard, C. 1856. Researches upon the cyprinid fishes inhabiting the fresh water of the United States of America, west of the Mississippi Valley, from specimens in the museum of the Smithsonian Institution. Proc. Acad. Nat. Sci. Phila. 8: 165-213.

DESCRIPTION, DISTRIBUTION, FISH, RIVER-Colorado

Description and classification of fishes that were collected during various surveys in the early 1850's, including species in the Colorado River system.

306. Girard, C. 1859. Ichthyology of the boundary. Pages 1-85 in W. H. Emory, Report 3 of the United States and Mexican Boundary Survey, made under the direction of the Secretary of the Interior and United States Commissioner.

DESCRIPTION, DISTRIBUTION, FISH, RIVER-Colorado

Description of fish that were collected in an early Mexican boundary survey (1851-1855) including those from the Colorado River system.

307. Gloss, S., B. May, and R. Stone. 1973. Glen Canyon Reservoir-Lake Powell post-impoundment investigation; 1972-1973 annual performance report. Utah Div. Wildl. Resour., Salt Lake City, Publ 74-11. 10 pp.

FISH, LIMNOLOGY, MANAGEMENT, RESERVOIR, RIVER-Colorado

Describes a survey of the limnology and fishery of Glen Canyon Reservoir (Lake Powell) in 1973.

308. Gloss, S., V. Starostka, and C. Thompson. 1971. Glen Canyon Reservoir post-impoundment investigations. Utah Div. Wildl. Resour., Salt Lake River Storage Proj. 18 pp. and Appendix.

FISH, LIMNOLOGY, MANAGEMENT, RESERVOIR, RIVER-Colorado

Describes a survey of the limnology and fishery of the Glen Canyon Reservoir (Lake Powell) in 1971.

309. Gloss, S., V. Starostka, C. Thompson, and A. F. Regenthal. 1970. Glen Canyon Reservoir post-impoundment investigation. Utah Div. Fish Game, Salt Lake City, Prog. Rep. 7. 21 pp.

FISH, LIMNOLOGY, MANAGEMENT, RESERVOIR, RIVER-Colorado

Describes a survey of the limnology and fishery of the Glen Canyon Reservoir (Lake Powell) in 1970.

310. Glover, R. E., C. A. Nelson, and J. I. Sanders. 1974. Colorado River flow management. Am. Soc. Civil Eng., J. Hydraul. Div. 100 (HY11): 1519-1535.

MANAGEMENT, RIVER-Colorado, STREAMFLOW

Describes the needs and the procedures developed for improving the monitoring of transient flow changes of the Colorado River from Parker Dam to Imperial Dam, Arizona-California. The procedures are applicable to other reaches of the Colorado River.

311. Goettl, J. P. 1969. Water pollution studies: study of the effects of metallic ions on fish and aquatic organisms. Colo. Game Fish Parks Dep., Denver. Fed. Aid Proj. F-033-R-05, Job 6. 19 pp.

FISH, POLLUTION, WATER QUALITY

Provides information on the toxic effects of lead and zinc on rainbow trout.

312. Goettl, J. P. 1970. Water pollution studies: study of the effects of metallic ions on fish and aquatic organisms. Colo. Game Fish Parks Dep., Denver. Fed. Aid Proj. F-033-R-06, Job 6. 80 pp.

FISH, POLLUTION, WATER QUALITY

Provides information on the toxicity thresholds of lead, zinc, and copper for rainbow trout. Also provides a technique for the differential staining of fish blood cells.

313. Goettl, J. P. 1970. Water pollution studies: study of the effects of mineral mining and milling operations on high mountain streams. Colo. Game Fish Parks Dep., Denver. Fed. Aid Proj. F-033-R-06, Job 1. 50pp.

ABUNDANCE, FISH, INVERTEBRATE, POLLUTION, WATER QUALITY

Evaluates the effects of mine tailings (zinc, copper, and lead) on brook, brown, and rainbow trout and invertebrates of coldwater streams in western Colorado.

314. Goettl, J. P., Jr., and P. H. Davies. 1975. Water pollution studies: Study of the effects of mining and milling operations on high mountain streams. Colo. Div. Wildl., Denver. Fed. Aid Proj. F-33-R-10, Job 1: 1-6.

FISH, INVERTEBRATE, MINERAL, POLLUTION, WATER QUALITY

Continuing studies to determine the effects of hard rock mining and milling operations on fish, invertebrates, and water quality. Other studies were reported from 1970 to 1975; see bibliography by Cope (1977).

315. Goettl, J. P., Jr., and P. H. Davies. 1979. Water pollution studies: Colo. Dep. Nat. Resour., Div. Wildl., Denver. Job Progr. Rep., Fed. Aid Proj. F-33-R-14, Jobs 1 and 6. 43 pp.

FISH, MINERAL, POLLUTION, WATER QUALITY

Job 1 is a continuing study to determine the effects of hard-rock mining and milling operations on fish, invertebrates, and water quality. Job 6 is a continuing study on the effects of heavy metals (lead, zinc, cadmium, silver, and copper on rainbow trout in soft and hard waters. See the bibliography by Cope (1977) for references to previous studies.

316. Goettl, J. P., Jr., and J. W. Edde. 1978. Environmental effects of oil shale mining and processing. Part I - Fishes of Piceance Creek, Colorado, prior to oil shale processing. U. S. Environ. Protect. Agency, EPA-600/3-78-096. 27 pp.

ENERGY, FISH, MINERAL, RIVER-White, SURVEY

Survey of the fishes of Piceance Creek, Colorado, prior to extensive oil shale processing in the area. The mountain sucker and the speckled dace were the most abundant and widespread fishes found in this stream. However, the numbers of all species were not great. The largest number of fish captured per 100 meters of stream was 76 individuals, while the range for all other stations was 3-23 fish/100 m. Brook, brown, and rainbow trout, respectively, were the most common in the upper reaches of Piceance Creek and its tributaries, Black Sulphur Creek and Stewart Creek.

317. Goettl, J. P., Jr., and J. R. Sinley. 1975. Water pollution studies: Study of the effects of metallic ions on fish and aquatic organisms. Colo. Div. Wildl., Denver. Prog. Rep., Fed. Aid Proj. F-33-R-5, Job 6: 39-57.

FISH, INVERTEBRATE, POLLUTION

Continuing studies to determine the effects of metallic ions on fish and other aquatic organisms. Other studies were reported from 1970 to 1975; see bibliography by Cope (1977).

318. Goettl, J. P., J. R. Sinley, and P. H. Davies. 1971. Water pollution studies: study of the effect of metallic ions on fish and aquatic organisms. Colo. Game Fish Parks Dep., Denver. Fed. Aid Proj. F-033-R-07, Job 6. 17 pp.

FISH, INVERTEBRATE, POLLUTION, WATER QUALITY

Bioassays were conducted in soft and hard water to determine the effects of lead, copper, and zinc on rainbow trout and zinc, lead, copper, cadmium, and silver on mayflies and stoneflies.

319. Gold, R. L., J. M. Milligan, and C. G. Clyde. 1969. Formulation of a mathematical model for the allocation of Colorado River waters in Utah. Utah Water Res. Lab. Utah State Univ., Logan, PRWG 73-1. 39 pp.

MANAGEMENT, MODEL, RIVER-Colorado

Mathematical model for use of Colorado River water in Utah that contains 115 variables and 64 constraints. It optimizes the allocation model under different demands and considers the limitations of legal, political, and social constraints.

320. Goldman, C. R. 1973. Environmental impact and water development. Pages 1-11 in C. R. Goldman, J. McEvoy III, and P. J. Richerson, eds. Environmental quality and water development. W. H. Freeman and Co., San Francisco.

ECOLOGY, MANAGEMENT, RECLAMATION, RECREATION, RIVER-Colorado

Summary of effects of water development on the environment and recommendations for a better balance between water development and environmental quality. Provides examples of conflicts between users of water, including the effects of impoundments on recreational rafting on the Colorado River.

321. Goldwater, B. M. 1970. Delightful journey down the Green and Colorado Rivers. Arizona Historical Foundation, Tempe. 219 pp.

DESCRIPTION, RECREATION, RIVER-Colorado, Green

Photographic narration by Barry Goldwater of a float trip from Green River, Utah, on the Green River to Lake Mead on the Colorado River shortly before the closure of Glen Canyon Dam, with comments on his trip down the same reach in 1940.

322. Golze, A. R. 1961. Reclamation in the United States. The Caxton Printers, Ltd., Caldwell, Idaho. 486 pp.

IRRIGATION, POWER, RECLAMATION

Discusses the process of reclaiming the desert lands of the western United States through irrigated agriculture, supported by coordinated development of hydroelectric power. Includes aspects such as project feasibility, high-dam construction, land settlement, and repayment contracts.

323. Goodwin, H. A. 1973. Ecology and endangered species. Trans. N. Am. Wildl. Nat. Resour. Conf. 38: 46-55.

ECOLOGY, FISH, WILDLIFE

Describes a long-range system to rate priorities of action with the application of ecology by the International Union for Conservation of Nature and Natural Resources.

324. Gordon, Y. 1972. Inter-relationship of water quantity and quality as a determinant of water management policy. Water Res. 6(12): 1501-1508.

MANAGEMENT, POLICY, RIVER-Colorado, WATER QUALITY, WATER QUANTITY

Summary of the importance of quality and quantity of water as related to policy in water management. The Colorado River is given as an example.

325. Gosz, J. R. 1980. The influence of reduced streamflows on water quality. Chapter 7 in W. O. Spofford, Jr., A. L. Parker, and A. V. Kneese, eds. Energy development and the water, fish, and wildlife in the Southwest: Problems of the upper Colorado River basin. Resources for the Future, Washington, D. C. In press.

RIVER-Colorado, STREAMFLOW, WATER QUALITY

Provides a comprehensive discussion on the interactions between hydrology of the area, reductions in streamflow, and resultant changes in water quality. The example from New Mexico provides insight into changes that could occur throughout the upper Colorado River from water diversions of streams and reduced streamflows.

326. Grant, L. O., C. F. Chappell, L. W. Crow, J. M. Fritsch, and P. W. Mielke, Jr. 1974. Weather modification: a pilot project. Colo. State Univ., Dep. Atmos. Sci., Fort Collins. Final Rep. to U. S. Bur. Reclam., Denver. Contract DI-14-06-D-6467. Natl. Tech. Inf. Serv., Springfield, Va. PB-237 085/65L. 76 pp.

CLOUD SEEDING, PRECIPITATION, RIVER-Colorado, WEATHER

Concerns the preparation of a design program to apply results from experimental programs for augmenting orographic precipitation to a Pilot Program that would have the goal of providing "sound scientific and engineering evaluation of precipitation seeding techniques . .

327. Graves, E., and B. Haines. 1969. Fishery investigations - Navajo Unit: Fishery surveys of Navajo Reservoir and tailwaters. Job No. A-6(a) and A-6(b), Section 8, Colorado River Storage Proj., New Mexico Dep. Game and Fish, Albuquerque. 103 pp.

ABUNDANCE, FISH, FISHERY, INVERTEBRATE, RESERVOIR, RIVER-San Juan, WATER QUALITY

The sixth and final segment of a 6-year research project on Navajo Reservoir and tailwaters of the San Juan River in New Mexico. Provides the only available information on the invertebrates in the San Juan River. Also provides information on fish abundance, fish stocking, and creel census. Chemical and temperature profiles for Navajo Lake are summarized by month.

328. Graves, E., and B. Haines. 1969. Fishery surveys of Navajo Reservoir and tailwaters. Navajo Reservoir Res. Contract, N.M. Dep. Game Fish, Albuquerque. Job Completion Rep. Job No. A-6(a) and A-6(b). 103 pp.

FISH, FISHERY, INVERTEBRATE, MANAGEMENT, RIVER-San Juan, WATER QUALITY

This report is primarily concerned with the sport fishery of Navajo Reservoir although it includes information on the distribution and abundance of three endemic fishes (flannelmouth and bluehead suckers and bonytail chub). Also gives information concerning visitor use and fishing success, as well as stocking information for 1962-68. Provides some data on distribution of invertebrates.

329. Gray, L. J., and J. V. Ward. 1978. Environmental effects of oil shale mining and processing. Part II - The aquatic macroinvertebrates of the Piceance Basin, Colorado, prior to oil shale processing. U. S. Environ. Protect. Agency, EPA-600/3-78-097. 48 pp.

ENERGY, INVERTEBRATE, MINERAL, RIVER-White, SURVEY

The macroinvertebrate communities of Piceance Creek, Colorado, and its tributaries were sampled prior to extensive oil shale processing in the area. The fauna of upstream areas of Piceance Creek and its tributaries was composed primarily of winter species (those that complete their life cycle from fall to spring) whereas the fauna of downstream reaches of Piceance Creek was composed almost entirely of summer species. The concentration of sodium, sulfate, chloride, and total dissolved solids increased greatly in the downstream direction. The range of temperature, turbidity, severity of winter ice conditions, and effects of grazing and irrigation activities also increased downstream.

330. Greene, A. F. C. 1975. The need for cooperative approaches to fish and wildlife management planning. Trans. N. Am. Wildl. Natl. Resour. Conf. 40: 133-141.

FISH, MANAGEMENT, PLAN, WILDLIFE

Because of constraints being placed on our natural resources, it is essential for federal and state conservation agencies to cooperate on common plans for fish and wildlife management.

331. Gregg, D. O., E. L. Meyer, M. M. Targy, and F. A. Moulder. 1961. Public water supplies of Colorado, 1959-1960. U. S. Geol. Surv., in Cooperation with Colorado State Univ. Agric. Exp. Stn. 128 pp.

GROUNDWATER, POLLUTION, POPULATION, WATER QUALITY, WATER QUANTITY

Describes the source, treatment, and volumes of water used for public supplies in Colorado's cities and towns, including those in the Colorado River drainage.

332. Gregory, H. E. 1916. The Navajo country: a geographic and hydrographic reconnaissance of parts of Arizona, New Mexico, and Utah. U. S. Geol. Surv., Water-Supply Pap. 380. 210 pp.

CLIMATE, GEOLOGY, GROUNDWATER, HYDROLOGY, STREAMFLOW

Gives information on the climate, geology, and water resources of parts of Arizona, New Mexico, and Utah.

333. Gregory, R. W. 1965. Effect of inorganic concentration of some warmwater fishes. Colo. Dep. Game Fish Parks, Denver. Job Completion Rep. Fed. Aid Proj. F-29-R-1. 39 pp.

FISH, MINERAL, SALINITY, WATER QUALITY

Survey of salinity in 15 reservoirs for 10 months. Total dissolved solids ranged from 200 to 14,000 ppm. Various concentrations of sodium, potassium, magnesium, carbonate, sulfates, and halides were tested on the eggs and sperm of walleyes and northern pike.

334. Grigman, R. D. 1964. Ecological history and biological resources of San Juan County, Utah. M. S. Thesis, Univ. Utah, Salt Lake City. 100 pp.

DESCRIPTION, ECOLOGY, HISTORY, RESOURCES, RIVER-Colorado

Describes the physiography, geology, and climatology, as well as history of human occupancy and land use. Includes checklist, taken from the literature, of the plants and animals including fish.

335. Grim, E. C., and R. D. Hill. 1974. Environmental protection in surface mining of coal. U. S. Environ. Protect. Agency, Cincinnati, Ohio. 277 pp.

ECOLOGY, MINERAL, RESOURCES

Outlines methods for the protection of the environment during surface coal mining.

336. Grimes, A. E. 1972. Annotated bibliography on weather modification, 1960-1969. U. S. Natl. Ocean. Atmos. Admin., Tech. Memo. EDS ESIC-1. 413 pp.

BIBLIOGRAPHY, PRECIPITATION, WEATHER

Bibliography on a decade of weather modification efforts.

337. Grinnell, J. 1914. An account of the mammals and birds of the lower Colorado Valley. Univ. California Publ. Zool. 12: 51-294.

DESCRIPTION, DISTRIBUTION, FISH, RIVER-Colorado, VEGETATION, WILDLIFE

Broad and rather comprehensive description of wildlife in the lower Colorado River Valley including the river morphology, native fish species, and man's effect on the river.

338. Gunnerson, C. G. 1966. An atlas of water pollution surveillance in the United States, October 1, 1957 to September 30, 1965. U. S. Fed. Water Pollut. Contr. Admin., Div. Pollut. Surveill., Cincinnati, Ohio. 48 figures.

INVERTEBRATE, MINERAL, POLLUTION

Atlas of U. S. waters, with information on algae, invertebrates, minerals, and pesticides.

339. Gustafson, E. S. 1975. Early development, adult sexual dimorphism, and fecundity of the razorback sucker, *Xyrauchen texanus* (Abbott). Lower Colorado River Basin Res. Lab., Arizona State Univ., Tempe. Final Rep. to U. S. Fish and Wildl. Serv., Albuquerque, N. M. 43 pp.

DESCRIPTION, DISTRIBUTION, FISH, LIFE HISTORY, RIVER-Colorado

Details the development of eggs and larvae from time of fertilization until day 227 for *Xyrauchen texanus*. Describes six sexually dimorphic characteristics for adult *Xyrauchen*, and fecundity of five adult females.

340. Hagen, H. K. 1962. A preliminary survey of the vertebrate and invertebrate faunas of Dinosaur National Monument. Colorado State Univ., Fort Collins. 17 pp. (Unpubl. manuscr.)

FISH, INVERTEBRATE, RIVER-Green

Reports on two cursory surveys of fish and invertebrates in Dinosaur National Monument during fall 1961.

341. Hagen, H. K., and J. L. Banks. 1963. Ecological and limnological studies of the Green River in Dinosaur National Monument. U. S. Natl. Park Serv. and Colo. State Univ., Fort Collins, Contract 14-10-0232-686. 31 pp.

DISTRIBUTION, FISH, LIMNOLOGY, RIVER-Green, Yampa

Description of fish and invertebrate sampling in Dinosaur National Monument during the summers of 1961-62. Two Colorado squawfish were collected at Split Mountain in 1962 but none at the Gates of Ladore, Echo Park, Island Park, or Castle Park.

342. Hains, C. F., D. M. Van Sickle, and H. V. Peterson. 1952. Sedimentation rates in small reservoirs in the Little Colorado River Basin. U. S. Geol. Surv. Water-Supply Pap. 1110-D: 129-155.

GEOLOGY, HYDROLOGY, MANAGEMENT, RIVER-Colorado, SEDIMENT, SOIL

Measurement of sedimentation rate in a group of small reservoirs. Suggested a method for determining the origin of sediment and estimating the rate of movement from headwater areas in various geologic formations. Striking differences occurred in the rate of annual sediment movement that was influenced mainly by underlying rocks, as well as the soil, slope, cover, and land use. The results help to delineate areas of great erosion potential and are therefore useful in devising plans of treatment aimed at erosion abatement.

343. Hamilton, H. R., D. H. Owens, T. E. Carroll, A. R. Glenn, and B. A. Gilmour. 1966. Bibliography on socio-economic aspects of water resources. Prepared by Battelle Memorial Institute, Columbus, Ohio, for U. S. Office of Water Resources Research, Washington, D. C. 453 pp.

BIBLIOGRAPHY, ECONOMICS, POLICY, RESOURCES, SOCIOLOGY

Annotated bibliography that includes references on the supply and demand of water, cost-benefit analyses, economic impact of water resources and water development, and methods of determining economic values of sport fisheries, wildlife, and other aquatic outdoor recreation resources.

344. Hancock, E. T. 1915. Shorter contributions to general geology, 1914: the history of a portion of the Yampa River, Colo., and its possible bearing on that of the Green River. U. S. Geol. Surv. Prof. Pap. 90: 183-189.

GEOLOGY, HISTORY, RIVER-Green, Yampa

Describes the history and geology of the Yampa River and its relation to the Green River.

345. Hanke, S. H. 1973. The political economy of water resources development. Trans. N. Am. Wildl. Nat. Resour. Conf. 38: 377-389.

ECONOMICS, MANAGEMENT, POLICY, WATER QUANTITY

Focuses on the nature, causes, consequences, and remedies for the evaluation-reimbursement dichotomy of water resources development.

346. Hansen, W. R. 1965. Geology of the Flaming Gorge area. Utah-Colorado-Wyoming. U. S. Geol. Surv. Prof. Pap. 490. 190 pp. + maps.

GEOLOGY, RECLAMATION, RESOURCES, SURVEY

Describes the geographic history and provides information on the mineral resources of this area. The immediate objective of the report was to provide geologic background data to aid construction agencies in finding raw materials, interpreting ground conditions at the construction site, and uncovering potential problems related to construction outside of the construction area. Secondly, this information was to be used in a geologic atlas of the United States.

347. Hansen, W. R. 1969. The geologic story of the Uinta Mountains. U. S. Geol. Surv. Bull. 1291. 144 pp.

GEOLOGY, RIVER-Green

Discusses the geology of the Uinta Mountains in East Central Utah, which form an important drainage for the Green River.

348. Harbeck, G. E., Jr. 1948. Reservoirs in the United States. U. S. Geol. Surv. Circ. 23. 72 pp.

IRRIGATION, RESERVOIR, RIVER-Colorado and tributaries

General information, drainage maps, and storage tables for reservoirs in the United States, including those in the Colorado River Basin.

349. Harris, A. H., and F. W. Eddy. 1963. Vertebrate remains and past environmental reconstruction in the Navajo Reservoir District. Museum of New Mexico, Pap. Anthropology 11, Mus. of New Mexico Press, Santa Fe. 71 pp.

ARCHAEOLOGY, DAM, DESCRIPTION, RESERVOIR, RIVER-San Juan, WILDLIFE

Description of ancient vertebrate remains (including fish) at the Navajo Reservoir site on the San Juan River in New Mexico.

350. Hayes, M. L. 1956. Life history studies of two species of suckers in Shadow Mountain Reservoir, Grand County, Colorado. M. S. Thesis, Colorado State Univ., Fort Collins. 126 pp.

FISH, LIFE HISTORY, RIVER-Colorado

Basic life history study of the longnose and white suckers in a reservoir that empties into the Colorado River near the village of Grand Lake, Colorado.

351. Hayes, S. P. 1935. A taxonomical, morphological, and distributional study of the Utah Cyprinidae. M. A. Thesis, Brigham Young Univ., Provo, Utah. 115 pp.

DESCRIPTION, DISTRIBUTION, FISH

Summarizes the distribution, morphology, and taxonomy of Utah minnows (family Cyprinidae) including native species in the Colorado River drainage such as the Colorado squawfish (pages 35-36) and the roundtail chub (pages 37-39).

352. Heald, W. F. 1963. The Colorado River of the West. Natl. Parks Mag. 37(193): 4-9.

GEOLOGY, HISTORY, RIVER-Colorado and tributaries

Popular narrative giving a brief description of the history and geology of the Colorado River Basin.

353. Heaney, J. P. 1968. Mathematical programming models for long-range river basin planning with emphasis on the Colorado River Basin. Ph.D. Thesis, Northwestern Univ., Evanston, Ill. 224 pp.

MANAGEMENT, MODEL, PLAN, RESOURCES, RIVER-Colorado

Uses mathematical models as a management tool to predict the best long-range use of water from the Colorado River.

354. Heede, B. H. 1975. Stages of development of gullies in the West. Pages 155-161 in Present and prospective technology for predicting sediment yields and sources. U. S. Dep. Agric., Agric. Res. Serv. ARS-S-40. 285 pp.

EROSION, GEOLOGY, HYDROLOGY, SEDIMENT

Compares the hydraulic geometry of gullies with that of rivers and indicates that vegetation near the channel could be used to determine the stability or stage of development in the gulley.

355. Hem, J. D. 1959. Study and interpretation of the chemical characteristics of natural water. U. S. Geol. Surv., Water-Supply Pap. 1473. 363 pp.

GEOLOGY, HYDROLOGY, POLLUTION, WATER QUALITY

Interprets the chemical characteristics of natural waters as affected by the hydrology and geology of an area.

356. Hepworth, D. K. 1976. Benthic fauna of recently inundated areas of Lake Powell, Utah-Arizona. Utah Div. Wildl. Resources, Publ. 76-17. 10 pp.

ABUNDANCE, INVERTEBRATE, RESERVOIR, RIVER-Colorado

Although the numbers of organisms never became great, colonization of newly inundated areas of Lake Powell occurred within a short time and maximum densities were reached in early August. Genera of the more commonly found chironomids peaked in abundance during July, August, and September. Changes in the density of different chironomids and occurrence of pupae in most samples indicated the emergence occurred throughout the summer and early fall.

357. Hepworth, D., and S. P. Gloss. 1976. Food habits and age-growth of walleye in Lake Powell, Utah-Arizona, with reference to introduction of threadfin shad. Utah Div. Wildl. Resources, Publ. 76-15. 13 pp.

AGE-GROWTH, FISH, FOOD HABITS, RESERVOIR, RIVER-Colorado

Before the introduction of shad, the diet was predominated by centrarchids. After introduction, walleyes fed almost exclusively on shad. A decrease in the frequency of empty stomachs and an increase in mean number of fish per stomach occurred after introduction of the shad. No change occurred in the volume of food that was ingested by walleyes. Growth of walleyes was similar for each year and changes in the diet did not result in any apparent change of growth.

358. Hepworth, D. K., A. W. Gustaveson, and R. Biggins. 1976. Lake Powell post-impoundment investigations: annual performance report--1975. Utah State Div. Wildl. Resources, Publ. 76-21. 36 pp.

AGE-GROWTH, FISH, FOOD HABITS, RECREATION, RESERVOIR, RIVER-Colorado

Annual report covering a number of topics such as the measurement of sport fishing harvest, pressure, and success; index of fish population trends; and evaluation of striped bass culture, growth, and introduction into the reservoir.

359. Hewston, J. G. 1966. Development of the recreational use patterns at Flaming Gorge Reservoir, 1963-1965. Ph.D. Thesis, Utah State Univ., Logan. 193 pp.

ECONOMICS, FISHERY, MANAGEMENT, RECREATION, RESERVOIR, RIVER-Green

Discusses the visitor facilities and their use at Flaming Gorge Reservoir in northeastern Utah and southwestern Wyoming.

360. Hewston, J. G., and D. R. Franklin. 1969. Recreational use patterns at Flaming Gorge Reservoir, 1963-1965. U. S. Bur. Sport Fish. Wildl., Resour. Publ. 70. 80 pp.

FISHERY, RECREATION, RESERVOIR, RIVER-Green

Activities, characteristics, and satisfactions of recreationists at Flaming Gorge Reservoir Utah-Wyoming, were studied in 1963-1965. Data were collected from interviews, questionnaires, creel censuses, and administrative agency records.

361. Hickman, G. L. 1973. An annotated index to statutory operating authorities of the Bureau of Sport Fisheries and Wildlife. U. S. Bureau of Sport Fisheries and Wildlife, Washington, D. C. 39 pp.

FISH, LAW, RIVER-Colorado and tributaries, WILDLIFE

Annotated index of federal laws that apply to the Bureau of Sport Fisheries and Wildlife (now the U. S. Fish and Wildlife Service) for the protection, enhancement, and conservation of fish and wildlife. Includes laws that deal directly with the Colorado River Basin, such as the Colorado River Storage Project Act.

362. Hickman, G. L. 1975. Incorporating the environmental quality dimension in planning river management. Trans. N. Am. Wildl. Nat. Resour. Conf. 40: 264-272.

ECOLOGY, MANAGEMENT, PLAN, WATER QUANTITY

Recommends that environmental quality be a part of the plan for the development of water resources for any purpose.

363. Hill, G. E., D. E. Stauffer, Jr., and H. K. Woodward. 1975. Assessment of cloud seeding programs and evaluation techniques in the State of Utah. Utah Division of Water Resources, Salt Lake City. 61 pp.

PRECIPITATION, WATER QUANTITY

Evaluation of cloud seeding as a method to augment water supply by increasing precipitation.

364. Hill, R. 1964. Stream fishery studies: White River survey. Colorado Dep. Game Fish Parks, Denver. Fed. Aid Proj. F-26-R-1, Job 2. 72 pp.

FISH, INVERTEBRATE, RIVER-White, STREAMFLOW

Stream depths, velocities, and habitat types were measured at varying rates of discharge. Preliminary estimates of optimum streamflows were made by analyses of historic flows, habitat type, trout food production, and fish populations.

365. Hill, R. R. 1965. Future quantity and quality of Colorado River water. Am. Soc. Civil Eng., Irrig. Drain. Div. J. 91: 17-30.

ECONOMICS, IRRIGATION, SALINITY, WATER QUALITY, WATER QUANTITY

The waters of the Colorado River contain about 0.9 ton of salt (dry weight) per acre-foot. Progressive depletions of the natural flow of Colorado River by upstream developments will have little effect on the total salt burden but a pronounced effect in the future on the concentrations of salts in the river water available for use. It is estimated that the average supply of water entering Lake Havasu, which was 11,821,000 acre-feet per year from 1941 to 1960, will not exceed 8,500,000 acre-feet in the future and that it might be as little as 7,500,000 acre-feet per year during the last 20 years of this century.

366. Hill, R. R. 1965. White River survey. Colo. Dep. Game Fish Parks, Fish. Res. Div., Denver. Fed. Aid Rep. F-26-R-2, Job 2. 54 pp.

ABUNDANCE, DISTRIBUTION, ECOLOGY, FISH, INVERTEBRATE, RIVER-White, RUNOFF, WATER QUALITY

The objectives of this federal aid project were to gather information on the fish populations and their environment in selected streams of Colorado. Data are given on the fish and invertebrates of the White River and on the types of aquatic habitat, by flow.

367. Hill, R. R., and W. T. Burkhard. 1967. White River Survey. Colo. Dep. Game Fish Parks, Fish. Res. Div., Denver. Fed. Aid Rep. F-26-R-3. 29 pp.

ABUNDANCE, DISTRIBUTION, ECOLOGY, FISH, INVERTEBRATE, RIVER-White, RUNOFF

Provides data on abundance and distribution of fish and invertebrates in Sweetwater Creek and the south fork of the White River. Also provides stream depths, velocities, and habitat types by flow.

368. Himmelblau, D. M., and R. V. Yates. 1968. New method of flow routing. Water Resour. Res. 4(6): 1193-1199.

MODEL, RIVER-Colorado, STREAMFLOW

Mathematical analysis and model of the flow in the Colorado River.

369. Hobbs, N., and J. D. Britton. 1974. Computer modeling applications in urban water planning. Am. Soc. Civil Eng. Tech. Memo 22. 42 pp. Also Natl. Tech. Inf. Serv., Springfield, Va. PB-233 673/3.

ALLOCATION, MODEL, PLAN, RIVER-Colorado, WATER QUANTITY

Describes techniques in systems analysis used in planning urban water supply systems. Descriptions, development histories, applications, and costs incurred are presented for seven models. Requirements for computer and model documentation are described.

370. Hoffman, G. L. 1974. Letter to Bruce Rosenlund, Alchesay-Williams Creek Natl. Fish Hatch., Whiteriver, Ariz. U. S. Fish Wildl. Serv., Eastern Fish Disease Lab., Leetown, W. Va. 23 July. 1 p.

FISH-rare

Verification of an identification of Myxosoma sp. in the liver and kidney of the Colorado squawfish.

371. Holburt, M. B., and V. E. Valentine. 1972. Present and future salinity of Colorado River. Am. Soc. Civil Eng. Hydraul. Div. J. 98(HY3): 503-520.

ECONOMICS, RIVER-Colorado, SALINITY, WATER QUALITY, WATER QUANTITY

Continued growth and development in the states of the Colorado River Basin will cause a substantial increase in salinity if measures are not taken to reduce salinity. This paper describes the water resources, uses of these resources, the salinity of the river, the principal sources of salinity, and the deleterious impact of salinity in the Colorado River Basin.

372. Holden, P. B. 1968. Systematic studies of the genus Gila (Cyprinidae) of the Colorado River basin. M. S. Thesis, Utah State Univ., Logan. 67 pp.

DESCRIPTION, FISH, FISH-rare, RIVER-Colorado

The roundtail chub, Gila robusta, and bonytail chub, G. elegans, are well separated morphologically, ecologically, and reproductively. The relationship between G. cypha and G. elegans is clouded by the presence of intergrades between the two forms.

373. Holden, P. B. 1973. Distribution, abundance and life history of the fishes of the upper Colorado River basin. Ph.D. Thesis, Utah State Univ., Logan. 59 pp.

ABUNDANCE, DISTRIBUTION, ECOLOGY, FISH, FISH-rare, LIFE HISTORY, MOVEMENT, RIVER-Colorado, Dolores, Green, Gunnison, Little Snake, White, Yampa

Gives detailed account of fish distribution and relative abundance in the main rivers of the upper basin. Also gives information on life history of some native fishes.

374. Holden, P. B. 1977. Habitat requirements of juvenile Colorado River squawfish. U. S. Fish Wildl. Serv., Off. Biol. Serv., Fort Collins, Colo. FWS/OBS-77/65. 70 pp.

DISTRIBUTION, FISH-rare, LIFE HISTORY, RIVER-Green, STREAMFLOW

Provides information on distribution and possible spawning sites for Colorado squawfish, humpback chubs, and razorback suckers. Electivity curves for substrate, velocity, depth, and habitat type were determined by life stage (young-of-the-year, sub-adult, and adult) for the Colorado squawfish and humpback chub.

375. Holden, P. B. 1978. A study of the habitat and movement of the rare fishes in the Green River, Utah. Trans. Am. Fish. Soc. 1: 64-89.

ABUNDANCE, FISH, HABITAT, MOVEMENT, RIVER-Green

Provides electivity curves of habitat preferences for Colorado squawfish and humpback chubs that were collected from the Green River in Desolation Canyon. This information is also found in Holden (1977).

376. Holden, P. B., and J. Irvine. 1975. A study of the aquatic fauna and flora of Escalante Canyon, Utah. Report of the U. S. Natl. Park Service, Denver Colo. 19 pp. (Unpubl. manuscr.)

FISH, HABITAT, POPULATION, RIVER-Escalante, STREAMFLOW, VEGETATION

A quantitative study of the fishes of the Escalante River with a description of the populations occupying various habitat types. Includes information on the riparian vegetation.

377. Holden, P. B., and C. B. Stalnaker. 1970. Systamatic studies of the cyprinid genus _Gila,_ in the upper Colorado River basin. Copeia 1970(3): 409-420.

DESCRIPTION, FISH, FISH-rare, RIVER-Colorado, Green, Yampa

A total of 309 specimens of _Gila_ from the Colorado River basin were studied by taximetrics analysis. The roundtail and bonytail chubs, _G. robusta_ and _G. elegans_, currently treated as subspecies, are well separated morphologically, ecologically, and apparently reproductively and are therefore best considered to be separate species. The relationship between _G. cypha_, the humpback chub, and _G. elegans_ is clouded by the presence of intergrades.

378. Holden, P. B., and C. B. Stalnaker. 1975. Distribution and abundance of mainstream fishes of the middle and upper Colorado River basins, 1967-1973. Trans. Am. Fish Soc. 104(2): 217-231.

ABUNDANCE, DISTRIBUTION, FISH, FISH-rare, RIVER-Colorado, Dolores, Duchesne, Green, Gunnison, Little Snake, White, Yampa

Twenty-nine species of fishes were collected in the middle and upper Colorado River basins in 1967-1973. The native suckers, _Catostomus latipinnis_ and _C. discobolus_, were the dominant species in the study area. Introduced species outnumbered native species 19 to 10. The abundance of introduced species has increased steadily since 1900 as has the number of new species introduced. Four endemic species, _Ptychocheilus lucius_, _Gila elegans_, _G. cypha_, and _Xyrauchen texanus_, are considered endangered. These rare forms reproduce in the lower Yampa River, Desolation Canyon of middle Green River, and the lower Green River in Canyonlands National Park. The major reasons for the decline of native fishes are considered to be alterations of habitat by high dams and introductions of exotic species.

379. Holden, P. B., and C. B. Stalnaker. 1975. Distribution of fishes in the Dolores and Yampa River systems of the upper Colorado basin. Southwest. Nat. 19(4): 403-412.

ABUNDANCE, DISTRIBUTION, FISH, FISH-rare, MOVEMENT, RIVER-Dolores, Yampa

Fish sampling was conducted in the Dolores River, Colorado, in 1971 and the Yampa River system of Colorado, in 1968-71, with emphasis on rare and endangered species. Eleven species were found in the Dolores River, but no rare and endangered forms were collected.

Twenty-two species were collected in the Yampa River system, including four rare and endangered forms: Colorado squawfish (Ptychocheilus lucius), humpback chub (Gila cypha), bonytail chub (G. elegans), and humpback sucker (Xyrauchen texanus). The Yampa system appeared important to reproduction and preservation of Colorado squawfish.

380. Holden, P. B., W. White, G. Somerville, D. Duff, R. Gervais, and S. Gloss. 1974. Threatened fishes of Utah. Proc. Utah Acad. Sci. Arts Lett. 51(Part 2): 46-65.

ABUNDANCE, DESCRIPTION, DISTRIBUTION, FISH-rare, RIVER-Colorado and tributaries

Gives a description of the fish with key characteristics; documents the decrease in range or abundance; gives the factors influencing the decline; and gives a brief description of recent studies on these fish. Provides recommendations for future research on threatened fish species found in Utah, including species found in the Colorado River basin.

381. Holder, D. C. 1960. A re-evaluation of the inflow-outflow equation for the Green River in Wyoming. M. S. Thesis, Univ. Wyoming, Laramie. 96 pp.

ALLOCATION, GROUNDWATER, HYDROLOGY, IRRIGATION, LAW, RIVER-Green, RUNOFF, STREAMFLOW, SURVEY, WATER QUANTITY

A re-evaluation of the inflow-outflow equation for the Green River in Wyoming for purposes of determining water supply and allocations from the 1922 compact, with a discussion of available records, land and water uses, and recommendations.

382. Holmes, B. H., G. G. Simons, and H. H. Ellis. 1972. State water-rights laws and related subjects: a supplemental bibliography, 1959 to mid-1967. U. S. Dep. Agric, Misc. Publ. 1249. 268 pp.

BIBLIOGRAPHY, LAW, POLICY

Bibliography covering publications from 1959 to 1967 on state water rights.

383. Holmgren, A. H. 1962. The vascular plants of the Dinosaur National Monument. Utah State Univ., Logan. 21 pp. (Unpubl. manuscr.)

RIVER-Green, Yampa, VEGETATION

Listing of plants found in Dinosaur National Monument.

384. Holmgren, A. H. 1962. The vascular plants of the Green River from the Flaming Gorge to Split Mountain Gorge. Utah State Univ., Logan. 40 pp. (Unpubl. manuscr.)

RIVER-Green, VEGETATION

A listing of the important vascular plants from the Flaming Gorge Dam site to Split Mountain Gorge.

385. Hood, J. W. 1976. Characteristics of aquifers in northern Uinta Basin area, Utah and Colorado. Utah Dep. Nat. Resour., Tech. Publ. 53. 71 pp.

GEOLOGY, GROUNDWATER, HYDROLOGY, STREAMFLOW, WATER QUANTITY

Discusses the relation between precipitation, geology, groundwater, and streamflow in a 13,500 km^2 area of the Uinta Basin of northeastern Utah and northwestern Colorado.

386. Hood, J. W. 1977. Hydrologic evaluation of Ashley Valley, northern Uinta Basin area, Utah. Utah Dep. Nat. Resour., Tech. Publ. 54. 25 pp.

GEOLOGY, GROUNDWATER, HYDROLOGY, WATER QUALITY, WATER QUANTITY

Discusses the water resources of the northern Uinta Basin, Utah and Colorado, from a study made during 1971-74. Provides information on groundwater, storage, and water quality in Ashley Valley.

387. Hood, J. W. 1977. Hydrologic evaluation of the upper Duchesne River Valley, northern Uinta Basin area, Utah. Utah Dep. Nat. Resour., Tech. Publ. 57. 34 pp.

GEOLOGY, GROUNDWATER, HYDROLOGY, RIVER-Duchesne, WATER QUALITY, WATER QUANTITY

Provides information on the quantity and quality of water in the Duchesne River in northern Utah based on the geology and hydrology of the area.

388. Hopper, R. M. 1968. Wetlands of Colorado. Colo. Game Fish Parks Dep., Denver, Tech. Publ. 22. 88 pp.

MANAGEMENT, RIVER-Colorado, Gunnison, SURVEY, WATER QUANTITY, WILDLIFE

An inventory and evaluation study of wetlands for waterfowl hunting. Includes a general description, economy, and waterfowl resources of the Uncompahgre-Gunnison-Colorado River Complex.

389. Horton, J. S. 1972. Management problems in phreatophyte and riparian zones. J. Soil Water Conserv. 27(2): 58-61.

MANAGEMENT, VEGETATION, WATER QUANTITY

Reviews the problems caused by the presence of phreatophytes in riparian zones of streams, with emphasis in water yield, flood control, and wildlife habitat and conservation.

390. Horton, J. S. 1973. Evapotranspiration and water research as related to riparian and phreatophyte management: an abstracted bibliography. U. S. Dep. Agric. Misc. Publ. 1234. 192 pp.

BIBLIOGRAPHY, VEGETATION, WATERSHED

Bibliography summarizes published information on (1) evaluation of the relations of vegetation to water loss, and (2) estimation of the probable effect of vegetation manipulation on water yield.

391. Horton, J. S., and C. J. Campbell. 1974. Management of phreatophyte and riparian vegetation for maximum multiple use values. U. S. For. Serv. Res. Pap. RM-117. 23 pp.

MANAGEMENT, VEGETATION

Summarizes the status of our knowledge about environmental relations of vegetation along water courses in the southwestern United States, and the effects on other resource values of vegetation management to reduce evapotranspiration. Suggests approaches to management of moist-site areas by zones, based primarily on water table depth, elevation, and tree species.

392. Howard, C. S. 1947. Suspended sediment in the Colorado River, 1925-1941. U. S. Geol. Surv., Water-Supply Pap. 998. 165 pp. + maps

RIVER-Colorado, SEDIMENT, WATER QUALITY

Provides the results of sediment-sampling by the Geological Survey in the Colorado River basin from 1 October 1925 to 30 September 1941. Information is given on the sizes of the particles of the sediment at the Grand Canyon, Willow Beach, and Bluff stations. The annual load at Grand Canyon ranged from 50,080,000 to 480,000,000 tons with a mean annual load of 200,200,000 tons. The mean annual runoff for the Grand Canyon station during the period was 12,640,000 acre-feet.

393. Howe, C. W., and K. W. Foster. 1971. Interbasin transfers of water: economic issues and impacts. John Hopkins Press for Resources for the Future, Baltimore. 196 pp.

ECONOMICS, RESOURCES, WATER QUANTITY

Discusses the water resources development of the West as applied to interbasin water transfer.

394. Howe, C. W., J. F. Kreider, and B. Udis. 1972. An economic analysis of the pollution problems in the Colorado River Basin: the Upper main stem sub-basin. Univ. Colo., Boulder, Interim Res. Rep.; and Natl. Tech. Inf. Serv., Springfield, Va. COM-74-11311/9. 257 pp.

AGRICULTURE, ECONOMICS, LAW, MODEL, POLLUTION, RIVER-Colorado, WATER QUALITY

Develops a set of compatible models relating the economic activities of the sub-basins of the Colorado River, both present and prospective, to air quality and water quantity and quality resulting from these patterns of economic activity. Describes in detail the models that have been developed and calibrated for the upper main stem sub-basin.

395. Howe, C. W., and D. V. Orr. 1974. Effects of agricultural acreage reduction on water availability and salinity in the upper Colorado River basin. Water Resour. Res. 10(5): 893-897.

AGRICULTURE, IRRIGATION, RIVER-Colorado, SALINITY, WATER QUANTITY

Review of water supply and salinity as related to a reduction in irrigated agriculture in the upper Colorado River basin.

396. Hubbs, C. L. 1954. Establishment of a forage fish, the red shiner (Notropis lutrensis), in the lower Colorado River system. Calif. Fish Game 40(3): 287-294.

ALTERATION, DISTRIBUTION, FISH, MANAGEMENT, RIVER-Colorado

The red shiner, which is native from the North Central States to northeastern Mexico, became established in Colorado River and connected waters of Arizona, Baja California, and California. The recent great depletion of the limited native fish fauna may have promoted the rapid increase of introduced fishes in the lower Colorado River system.

397. Hubbs, C. L., editor. 1958. Zoogeography. Washington, D. C., Am. Assoc. Advance. Sci., Publ. 51. 509 pp.

DISTRIBUTION, ECOLOGY, GEOLOGY, INSECT, INVERTEBRATE

A symposium on zoogeography that covers a number of animal groups in western North America, including amphibians, birds, fishes, insects, other invertebrates, mammals, and reptiles. A paper by R. R. Miller on origins and affinities of fishes is cited separately in the present bibliography. Two papers on macroinvertebrates that are found in the Colorado River Basin include "Some problems of freshwater invertebrate distribution in the western United States," by R. W. Pennak, pages 223-230 and "Affinities and origins of the northern and montane insects of western North America," by H. H. Ross, pages 231-252.

398. Hubbs, C. L., and J. E. Deacon. 1964. Additional introductions of tropical fish into southern Nevada. Southwest. Nat. 9(4): 249-251.

ABUNDANCE, ALTERATION, DISTRIBUTION, FISH

Exotic fishes that may compete with local endemics in the desert Southwest have recently been introduced into springs in southern Nevada. One species, *Cichlasoma severum*, not previously recorded in the United States, is added to the list of introduced Nevada fishes. Three species, *Mollienesia litipinna*, *M. mexicana*, and *C. nigrofasciatum*, are shown to have moved more than 80 miles within 15 months.

399. Hubbs, C. L., and L. C. Hubbs. 1947. Natural hybrids between two species of catostomid fishes. Pap. Mich. Acad. Sci. Arts Lett. 31(1945): 147-167.

DECRIPTION, FISH

Natural hybridization between catostomid fish in Colorado was reported for six specimens of *Catostomus latipinnis* x *Pantosteus delphinus* (now known as *Catostomus discobolus*). These species are not known to hybridize as frequently as other catostomids.

400. Hubbs, C. L., and E. R. Kuhne. 1937. A new fish of the genus *Apocope* from a Wyoming warm spring. Occas. Pap. Mus. Zool., Univ. Mich. 343. 21 pp. + 3 plates.

DESCRIPTION, ECOLOGY, FISH-rare, RIVER-Green tributary

Describes a new subspecies of minnow *Rhinichthys oscula thermalis* from Kendall Warm Springs, Wyoming, a tributary to the Green River. Provides numerous meristic counts and describes the habitat. This subspecies is unique to the Warm Springs. It is now considered endangered by the U. S. Fish and Wildlife Service.

401. Hubbs, C. L., and R. R. Miller. 1948. The zoological evidence: correlation between fish distribution and hydrographic history in the desert basins of western United States. Pages 17-166 *in* The Great Basin, with emphasis on glacial and postglacial times. Univ. Utah. Bull. 38(20).

DISTRIBUTION, FISH, HISTORY, HYDROLOGY, RIVER-Colorado and tributaries

Discusses the relation between ichthyological and physiographic evidence describing the history of stream and watershed evolution in several western watersheds.

402. Hubbs, C. L., and R. R. Miller. 1953. Hybridization in nature between the genera *Catostomus* and *Xyrauchen*. Pap. Mich. Acad. Sci. Arts Lett. 38: 207-233.

DESCRIPTION, FISH, FISH-rare

The genera of Catostomidae that hybridize in nature include *Chasmistes* and *Xyrauchen* as well as *Catostomus* and *Pantosteus* (now considered by most authors to be a subgenus of *Catostomus*). Two combinations are described, both between species endemic to the Colorado River system: (1) *Catostomus latipinnis* x *Xyrauchen texanus*, and (2) *C. insignis* x *X. texanus*. Greatly reduced numbers of *X. texanus* have probably increased the incidence of hybridization with other species of *Catostomus* that have remained abundant.

403. Hubbs, C. L., R. R. Miller, and L. C. Hubbs. 1974. Hydrographic history and relict fishes of the north-central Great Basin. Mem. Calif. Acad. Sci. 7. 259 pp.

FISH, HISTORY, HYDROLOGY

Monograph covering the Quaternary paleohydrography of central and eastern Nevada and a small portion of Utah, and speciation in fishes.

404. Hughes, T. C., E. A. Richardson, and J. A. Franckiewicz. 1974, 1975. Water salvage potentials in Utah. Vol. I (1974), Open water evaporation and monolayer suppression potential. Vol. II (1975), Evaporation suppression by reservoir destratification. Utah Water Res. Lab., Utah State Univ., Logan.

CLIMATE, HYDROLOGY, RESERVOIR, TEMPERATURE, WATER RESOURCE

Estimates the potential for evaporation suppression in Utah by the monolayer film method and the reservoir destratification method.

405. Hundley, N., Jr. 1966. Dividing the waters; a century of controversy between the United States and Mexico. Univ. California Press, Berkeley. 266 pp.

ALLOCATION, DESCRIPTION, HISTORY, LAW, RESOURCES, RIVER-Colorado, SOCIOLOGY, WATER QUALITY, WATER QUANTITY

The great need for water in the arid southwestern United States and northern Mexico causes bitter dispute over the control, division, and quality of the three rivers flowing through that area. This book gives a description of the natural setting; an account of the legal and historical negotiations and battles; and a retrospect and prospect for the future of these waters.

406. Hundley, N. 1975. Water and the West: the Colorado River compact and the politics of water in the American West. Univ. California Press, Berkeley. 416 pp.

HISTORY, LAW, RIVER-Colorado

Relates the history and politics of water development in the West and a review of the Colorado River Compact.

407. Hunt, C. B. 1956. Cenozoic geology of the Colorado Plateau. U. S. Geol. Surv. Prof. Pap. 279. 99 pp.

GEOLOGY, HISTORY, RIVER-Colorado

Geologic history of the Colorado Plateau in Cenozoic times.

408. Hunt, C. B., P. Averitt, and R. L. Miller. 1954. Geology and geography of the Henry Mountains region, Utah. U. S. Geol. Surv. Prof. Pap. 228. 234 pp.

DESCRIPTION, GEOLOGY

Describes the geology and geography of the Henry Mountains in southern Utah. Drainage from this area is into the lower reach of the upper Colorado River.

409. Hunt, J. D., J. J. Kennedy, S. F. McCool, L. E. Royer, and N. E. West. 1974. An initial effort in river use and management research for Canyonlands National Park. Institute for the Study of Outdoor Recreation and Tourism, Utah State Univ., Logan. 98 pp.

MANAGEMENT, RECREATION, RIVER-Colorado, Green, SOCIOLOGY, SURVEY

An attempt to provide guidelines for establishing acceptable levels of river use in Canyonlands National Park.

410. Hunt, J. D., J. J. Kennedy, N. E. West, W. J. Barmore, and H. Eklund. 1973. River use in Dinosaur National Monument--an interim report. Institute for the Study of Outdoor Recreation and Tourism, Utah State Univ., Logan. 42 pp.

MANAGEMENT, RECREATION, RIVER-Green, Yampa, SOCIOLOGY, SURVEY

Comments on river use in Dinosaur National Monument, preliminary to a more detailed problem analysis and problem-solving plan under way.

411. Hunter, M. R. 1939. The Mormons and the Colorado River. Am. Hist. Rev. 44(3): 549-555.

HISTORY, MIGRATION, POPULATION, TRANSPORTATION

General discussion of travel routes and problems encountered by Mormon immigrants. The Colorado River was explored for its potential to transport both people and supplies. Attempts were made to develop steamboat transport on the Colorado for European immigrants coming via Panama. These plans were halted with the establishment of a railroad.

412. Hutchins, W. A., H. H. Ellis, and J. P. DeBraal. 1971. Water rights laws in the nineteen western states. Vol. 1, U. S. Dep. Agric., Nat. Resour. Econ. Div., Econ. Res. Serv. Misc. Publ. 1206. 680 pp.

ALLOCATION, LAW, WATER RESOURCE

One of three volumes on water rights in the 19 western states. The three volumes provide a comprehensive treatment on this subject.

413. Hutchins, W. A., and D. W. Jensen. 1965. The Utah law of water rights. Utah State Engineer, Salt Lake City. 121 pp.

HISTORY, LAW, WATER QUANTITY

Reviews the history of water rights as applied to Utah.

414. Hyatt, M. L., J. P. Riley, M. L. McKee, and E. K. Israelson. 1970. Computer simulation of the hydrologic-salinity flow system within the Upper Colorado River Basin. Utah Water Res. Lab., Utah State Univ., Logan, PRWG 54-1. 121 pp.

HYDROLOGY, MODEL, RIVER-Colorado, SALINITY, STREAMFLOW

A model of the hydrology and salinity as a flow system in the upper basin.

415. Hynes, H. B. N. 1969. Ecology of flowing waters in relation to management. J. Water Pollut. Control Fed. 42(3): 418-424.

ECOLOGY, MANAGEMENT, STREAMFLOW, WATER QUANTITY

Summarizes the importance of ecology, including fish and wildlife, in watershed management.

416. Hynes, H. B. N. 1970. The ecology of running water. Univ. Toronto Press, Toronto, Ontario, Canada. 555 pp.

ECOLOGY, FISH, INVERTEBRATE, PLANKTON

A comprehensive coverage of the ecology of running water that applies to any watershed, including the upper Colorado River basin.

417. Interagency--Federal, Colorado, and Utah. 1972. The Green River: Flaming Gorge Dam to the Colorado River; a prelude for action. U. S. Bur. Land Manage., U. S. Bur. Outdoor Recreation, U. S. Bur. Reclam., U. S. Bur. Sport Fish. Wildl., Colo. Dep. Nat. Resour., U. S. Natl. Park Serv., U. S. For. Serv., and Utah Dep. Nat. Resour. 21 pp.

GEOLOGY, HISTORY, MANAGEMENT, RIVER-Green, SURVEY, VEGETATION

This report broadly describes the Green River below Flaming Gorge, with recommendations to protect and manage it as a valuable resource. Three segments of the river are designated as potential additions to the wild and scenic rivers system. Several maps are included and specific recommendations were made on several situations.

418. Iorns, W. V., C. H. Hembree, and G. L. Oakland. 1965. Water resources of the upper Colorado River Basin--technical report. U. S. Geol. Surv. Prof. Pap. 441. 370 pp. + plates.

RIVER-Colorado, STREAMFLOW, TEMPERATURE, WATER QUALITY

Introduction and summary of an appraisal of the water resources of the upper Colorado River Basin, with special emphasis on supply and quality of surface water.

419. Iorns, W. V., C. H. Hembree, D. A. Phoenix, and G. L. Oakland. 1964. Water resources of the upper Colorado River Basin--Basic data. U. S. Geol. Surv. Prof. Pap. 442. 1036 pp. + plates.

RIVER-Colorado and tributaries, STREAMFLOW, TEMPERATURE, WATER QUALITY

The compilation of basic data on the quantity and quality of water in the upper Colorado River Basin.

420. Ives, J. C. 1969. Report upon the Colorado River of the West. Da Capo Press, New York. 375 pp. (An unabridged replication of the first edition, published in Washington, D. C., in 1861.)

DESCRIPTION, GEOLOGY, HISTORY, RIVER-Colorado, SURVEY

Report on an exploratory survey of the Colorado River in 1857 and 1858 by the U. S. Army Corps of Topographical Engineers.

421. Jacobson, A. T. 1941. Geology of the North Fork and Upper Duchesne River Region. M. A. Thesis, Univ. Utah, Salt Lake City. 65 pp.

GEOLOGY, RIVER-Duchesne

Describes the geology of the Duchesne River Basin.

422. Jacoby, G. C., Jr. 1975. An overview of the effect of Lake Powell on Colorado River Basin water supply and environment. Univ. Calif., Inst. Geophys., Lake Powell Res. Proj. Bull. 14. 34 pp.

ECOLOGY, RESERVOIR, RIVER-Colorado, WATER QUANTITY

An analysis of the impact by the impoundment created by Glen Canyon Dam on the water supply and ecology of the Colorado River.

423. Jaffe, F. C. 1962. Oil shale. Part II--Geology and minerology of the oil shales of the Green River Formation, Colorado, Utah, and Wyoming. Colorado School of Mines, Golden, Mineral Ind. Bull. 5(3): 1-16.

GEOLOGY, MINERAL

Summarizes in one publication the essential information published on Green River oil shales since Bradley's investigations of 30 years earlier.

424. Jeppson, R. W., G. L. Ashcroft, A. L. Huber, G. V. Skogerboe, and J. M. Bagley. 1968. Hydrologic atlas of Utah. Utah Water Research Laboratory, Utah State Univ., Logan. 315 pp.

CLIMATE, GROUNDWATER, HYDROLOGY, PRECIPITATION, RUNOFF, STREAMFLOW, WATER QUALITY

Presents information in a probabilistic format adaptable to many user needs that depicts the climate and water supplies in the State of Utah. The major emphasis is on analyzing and combining pertinent data to present a total picture of the time and spatial variations of climate and streamflow of Utah.

425. Johnson, C. W., and S. H. Lewis. 1970. Contemporary developments in water law. Center for Res. in Water Resources, Univ. Texas, Austin. 177 pp.

LAW, MANAGEMENT, WATER RESOURCE

Describes contemporary developments regarding interpretation and application of current water laws.

426. Johnson, H. S. 1959. Uranium resources of the Green River and Henry Mountains Districts, Utah--a regional synthesis. U. S. Geol. Surv. Bull. 1087-C. 102 pp.

MINERAL, RESOURCES, SURVEY

A survey of uranium resources along the Green River and Henry Mountains.

427. Johnson, J. E. 1976. Status of endangered and threatened fish species in Colorado. U. S. Bur. Land Manage. Tech. Note, Form 1220-5. 21 pp. + 2 appendices.

ABUNDANCE, DISTRIBUTION, FISH-rare, MANAGEMENT, POLICY, RIVER-Colorado, Dolores, Green, Gunnison, White

This publication lists endangered and threatened fishes found in Colorado and gives a brief description of the fish, present distribution, and present management.

428. Johnson, J. E. 1977. Realistic management of endangered species: progress to date. Proc. Annu. Conf. West. Assoc. Game Fish Comm. 57: 298-301.

FISH-rare, MANAGEMENT

Reviews methods that are being used to prevent the extinction of a species and to maintain the habitat necessary for the continued existence for such species with an emphasis on listing of a threatened or endangered species, defining critical habitat, and producing a recovery plan.

429. Johnson, K. L. 1965. An analysis of state regulations of surface-ground water development and use in Colorado. Ph.D. Thesis. Colorado State Univ., Fort Collins. 118 pp.

GROUNDWATER, LAW, POLICY, WATER QUANTITY

Reviews regulations as pertinent to development and use of surface water and groundwater in Colorado.

430. Johnson, K. R. 1939. Plant ecology of northwestern Colorado lakes and surrounding areas. Ph.D. Thesis, Univ. Colorado, Boulder. 134 pp.

DESCRIPTION, ECOLOGY, RIVER-Colorado, White, VEGETATION

Describes the lake and zonation of Grand Lake, Trappers Lake, Aldrich Lake, Little Columbine Lake, and Lake John. Provides checklist of plants by season.

431. Johnson, R. W. 1975. Legal and institutional problems in the management of salinity. U.S. Office Water Res. Tech., Washington, D. C., Proj. Completion Rep. 18; and Natl. Tech. Inf. Serv., Springfield, Va. PB-244 730/8 ST. 47 pp.

IRRIGATION, LAW, MANAGEMENT, RIVER-Colorado, SALINITY

Examines the Colorado River basin salinity management program. The optimal solution will generally be found by considering the problem in the entire basin as a unit. The best solution is usually the one that would result in the least total cost per unit for the largest salinity reduction. This optimal solution, which requires extensive voluntary cooperation among all water users, has proven rather effective in the Colorado River basin.

432. Joint Committee on Atomic Energy. 1973. Understanding the "National Energy Dilema." The Center for Strategic and International Studies, Washington, D. C. 24 pp. + foldouts A-P.

ECOLOGY, ENERGY, MANAGEMENT, POLICY, RESOURCES

Summarizes the past energy uses by flow diagrams with the energy source or type, form of use, and efficiency of use, and projects future uses with similar flow diagrams based on assumed values for supply and demand. Concise summary of the energy dilemma facing the United States and how it came to be.

433. Jonez, A., and R. C. Sumner. 1954. Lakes Mead and Mohave investigations: a comparative study of an established reservoir as related to a newly created impoundment. Nev. Fish Game Comm., Reno, Final Rep. Dingell-Johnson Proj. F-1-R. 186 pp.

ABUNDANCE, DISTRIBUTION, ECOLOGY, ECONOMICS, FISH, FISH-rare, FOOD HABITS, INVERTEBRATE, LIFE HISTORY, PLANKTON, RIVER-Colorado, TEMPERATURE

Summary of a 3-year investigation (1951-54) to evaluate the ecology of Lake Mead (completed in 1935) and make recommendations for the management of the fishery in the lake. Also summarizes an ecological study of Lake Mohave (1950-54), a reservoir that was completed in 1951. Includes information on many aspects of the limnology and fish populations of these lakes, and describes the life histories of the humpback sucker, Colorado squawfish, and roundtail chub.

434. Jordan, D. S. 1885. Identification of the species of Cyprinidae and Catostomidae, described by Dr. Charles Girard, in the Proceedings of the Academy of Natural Sciences of Philadelphia for 1856. Proc. U. S. Natl. Mus. 8: 118-127.

DESCRIPTION, DISTRIBUTION, FISH

A reorganization of taxonomy of the minnows and suckers that were collected in western United States by Girard (1856) including species from the Colorado River.

435. Jordan, D. S. 1891. Report of explorations in Utah and Colorado during the summer or 1889 with an account of the fishes found in each of the river basins examined. U. S. Fish. Comm. Bull. 9: 1-40.

FISH, RIVER-Colorado, Green, Gunnison, San Juan, SURVEY

An early survey of selected rivers in Utah and Colorado with a description of the fish that were collected.

436. Jordan, D. S., and B. W. Evermann. 1896. The fishes of North and Middle America. U. S. Natl. Mus. Bull. 47. 4 parts, various pagination.

DESCRIPTION, FISH, FISH-rare

A descriptive compendium of the marine and freshwater species of fish-like vertebrates found in the waters of North America, north of the Isthmus of Panama. Anatomical figures and illustrations are also included.

437. Jordan, D. S., and B. W. Evermann. 1902. American food and game fishes. Doubleday, Page and Co., New York. 572 pp.

DESCRIPTION, DISTRIBUTION, FISH, FISH-rare, RIVER-Colorado

Description and distribution of North American fishes, including those found in the Colorado River Basin.

438. Jordan, D. S., and C. H. Gilbert. 1882. Synopsis of the fishes of North America. Bull. U. S. Natl. Mus. 16. 1018 pp.

DESCRIPTION, DISTRIBUTION, FISH

An early attempt to provide concise descriptions of all fish species known to inhabit the waters of North America, north of the Mexican boundary.

439. Joseph, T. W., J. A. Sinning, R. J. Behnke, and P. B. Holden. 1977. An evaluation of the status, life history, and habitat requirements of endangered and threatened fishes of the upper Colorado River system. U. S. Fish Wildl. Serv., Off. Biol. Serv., Fort Collins, Colo. FWS/OBS-77-62. 183 pp.

ALTERATION, ECOLOGY, FISH, HABITAT, INVERTEBRATE, LIFE HISTORY, STREAMFLOW

Literature review of the aquatic fauna of the upper Colorado River basin with an emphasis on endangered and threatened fishes - their status, habitat requirements, and overall ecology.

440. Jurinak, J. J., J. J. Hassett, S. H. Lai, and R. A. Griffin. 1970. Quality of irrigation return flow. Utah State Univ., Logan. Various pagination by sub-project. (Annu. Rep. to U. S. Fed. Water Qual. Adm., Proj. 13030 FOJ.)

IRRIGATION, SOIL, WATER QUALITY

Relates the chemistry of irrigated soils to the quality of drainage water from irrigation return flows.

441. Kahan, A. M. 1970. Weather modification potential for water supply in the Colorado River Basin. U. S. Bureau of Reclamation, Office of Atmospheric Water Resources, Denver, Colo. 36 pp.

PRECIPITATION, RIVER-Colorado, STREAMFLOW, WATER QUANTITY

Discusses the potential of modifying precipitation and increasing streamflow and water supply in the Colorado River.

442. Kalter, R. J. 1971. Economics of water based outdoor recreation: a survey and critique of recent developments. U. S. Army Eng., Inst. Water Resour. Rep. 71-8. 202 pp.

ECONOMICS, RECREATION, SURVEY, WATER RESOURCE

Provides a summary of economics of water-based outdoor recreation.

443. Kansgen, A. C. 1930. Geography of the Gunnison region, Colorado. M. A. Thesis, Univ. Colorado, Boulder. 57 pp.

DESCRIPTION

Describes the geography of the Gunnison drainage of Colorado.

444. Kapp, J. F., and R. C. Kroner. 1967. Trace elements in waters of the United States: a five-year summary of trace metals in rivers and lakes of the United States (Oct. 1, 1962 - Sept. 30, 1967). U. S. Federal Water Pollution Control Administration, Division of Pollution Surveillance, Cincinnati, Ohio. 32 pp. + 12 appendices.

MINERAL, SURVEY, WATER QUALITY

Five-year survey (1962-67) of trace metals in U. S. Waters, including those of Colorado River basin.

445. Keith, J., J. Anderson, and B. D. Gardner. 1975. The Colorado River and agriculture energy equations. Utah Sci. 36(3): 104-105.

AGRICULTURE, ENERGY, MODEL, RIVER-Colorado

Equations that model the use of Colorado River water.

446. Kelley, E. M. 1932. Treatment and softening of Colorado River water. Civil Eng. Thesis, Univ. Colorado, Boulder. 80 pp.

RIVER-Colorado, WATER QUALITY

Describes treatment to soften the water of the Colorado River.

447. Kidd, D. E. 1975. Bacterial contamination of Lake Powell waters: an assessment of the problem. Univ. Calif., Inst. Geophys., Lake Powell Res. Proj. Bull. 16. 32 pp.

POLLUTION, RECREATION, RESERVOIR, RIVER-Colorado, WATER QUALITY

The results of analyses for total coliform, fecal coliform, fecal streptococci, and Salmonella led to the conclusion that Lake Powell waters are not safe to drink, but are safe for body-contact recreational use. A linear regression model for estimating safe and hazardous water conditions is presented.

448. Kidd, G. 1974. Preliminary report on endangered and threatened endemic warmwater species of fish in western Colorado rivers. Colo. Div. Wildl., Denver. Federal Aid Proj. F-30-R-11. 16 pp.

ABUNDANCE, ALTERATION, DISTRIBUTION, FISH, FISH-rare, HABITAT, MANAGEMENT, RIVER-Colorado, Gunnison, SURVEY

Survey of distribution and abundance of fish in the Colorado and Gunnison Rivers near Grand Junction, Colorado.

449. Kidd, G. 1977. An investigation of endangered and threatened fish species in the Upper Colorado River as related to Bureau of Reclamation projects. Northwest Fish. Res., 3361 G. Road, Route 1, Clifton, Colo. 37 pp.

FISH, INVERTEBRATE, RIVER-Colorado, Gunnison, STREAMFLOW, WATER QUALITY, WATER QUANTITY

Summary of a field survey conducted February through November of 1976 on the Colorado and Gunnison Rivers between Grand Junction, Colorado, and Moab, Utah, with emphasis on the Colorado squawfish, humpback chub, bonytail chub, and razorback sucker. Also provided information on the distribution and abundance of other fish and macroinvertebrates. This work was contracted by the U. S. Bureau of Reclamation and the report is available at their Western Colorado Projects Office, P. O. Box 1728, Grand Junction, Colo. 81501.

450. Kimsey, J. B. 1957. Fisheries problems in impounded waters of California and the lower Colorado River. Trans. Am. Fish. Soc. 87: 319-332.

FISH, FISHERY, MANAGEMENT, RESERVOIR, RIVER-Colorado

Native freshwater fish populations in California and the lower Colorado River have not adjusted to the combination of impoundment and predation by introduced warmwater species. Doubling the amount of impounded waters in California is in the foreseeable future. Over a period of years after construction, the reservoirs experience a typical pattern of high initial fishing success, a sharp decrease, and then a gradual rise to a fishery somewhere near half the magnitude of that during the initial phase. Management practices are based on attempts to reduce the decline and maintain a fishery as close to that of the initial phase as possible. Introduction of the threadfin shad into the lower Colorado River as a forage species has been highly successful.

451. Kindswater, C. E., editor. 1964. Organization and methodology for river basin planning. Water Resources Center, Georgia Institute of Technology, Atlanta. 561 pp.

CLIMATE, ECONOMICS, HYDROLOGY, MANAGEMENT, POLICY, RESOURCES

The proceedings of a seminar to stimulate an exchange of informed opinions regarding the state of the art of comprehensive river basin planning. Although the seminar emphasized river basins in southeastern United States, the principles and recommendations are applicable to river basins of western United States.

452. King, A. B., J. C. Andersen, C. G. Clyde, and D. H. Hoggan. 1972. Development of regional supply functions and a least-cost model for allocating water resources in Utah: a parametric linear programming approach. Utah Water Res. Lab., Logan, Rep. PRWG 100-2, and Natl. Tech. Inf. Serv., Springfield, Va., AD/A-000 822/7SL. 169 pp.

ALLOCATION, ECONOMICS, HYDROLOGY, MODEL, WATER RESOURCE

A statewide linear programming allocation model was developed to meet projected requirements, subject to various hydrologic constraints and limits on diversions.

453. King, P. B. 1958. Evolution of modern surface features of Western North America. Pages 3-60 in C. L. Hubbs, ed. Zoogeography. Washington, D. C., Am. Assoc. Adv. Sci. Publ. 51.

GEOLOGY

Western North America is the region of the Cordilleran system of mountain ranges whose growth phases are geo-synclinal, orogenic, and post-orogenic. It was during the post-orogenic phase that modern surface features evolved in Tertiary and Quarternary times. Landscape of the region has been further shaped by surface processes of erosion, sedimentation, and volcanism.

454. Kinnear, B. S. 1967. Fishes of Black Canyon. M. S. Thesis, Colorado State Univ., Fort Collins. 52 pp.

DISTRIBUTION, ECOLOGY, FISH, INVERTEBRATE, RESERVOIR, RIVER-Gunnison, VEGETATION

Distribution of fish in the Black Canyon of the Gunnison River, with discussion of their ecology and water development projects. Also published as: Kinnear, B. S., and R. E. Vincent. 1967. Fishes and fish habitats in Black Canyon of the Gunnison National Monument. Colorado State Univ., Fort Collins. Completion rep. to U. S. Natl. Park Serv., Contract 10-14-0232-849. 45 pp.

455. Kinney, D. M. 1955. Geology of the Uinta River--Brush Creek Area, Duchesne and Uintah Counties, Utah. U. S. Geol. Surv. Bull. 1007. 185 pp.

GEOLOGY, RIVER-Duchesne and tributaries

Description of the geology of the Brush Creek area, Uinta River, Utah.

456. Kirsch, P. H. 1889. Notes on a collection of fishes obtained in the Gila River at Fort Thomas, Arizona. Proc. U. S. Natl. Mus. 11: 555-558.

DESCRIPTION, FISH, RIVER-Colorado

Describes the new genus Xyrauchen.

457. Kittrell, F. W. 1969. A practical guide to water quality studies of streams. U. S. Fed. Water Pollut. Control Adm. CWR-5. 135 pp.

FISH-rare, WATER QUALITY

A general guide applicable to water quality of streams.

458. Klein, W. D. 1952. Voluntary returns from plants of tagged trout 1946 through 1951. Colorado Game and Fish Department, Fish Management Division, Denver. 92 pp.

FISH, FISHERY, MANAGEMENT, RIVER-Colorado, White, Yampa

Summarizes the returns in 1946-51 of tagged legal-sized hatchery trout that were planted in 1946-49 in various Colorado waters, including Shadow Mountain Reservoir, Grand Lake, and Colorado, Gunnison, White, and Yampa Rivers.

459. Klein, W. D. 1957. A partial census of the whitefish and trout population in the Yampa and White Rivers and their tributaries. Colo. Dep. Game Fish, Denver. Spec. Purpose Rep. 47. 18 pp.

ABUNDANCE, DISTRIBUTION, FISH, RIVER-Little Snake, White, Yampa

Provides information on abundance, age, and growth of trout and whitefish in the White and Yampa Rivers, and abundance in the Little Snake River.

460. Klein, W. D. 1958. Results of fingerling rainbow trout plants in the Williams Fork, Eagle, and Colorado Rivers. Colo. Dep. Game Fish, Denver. Spec. Purpose Rep. 55. 12 pp.

FISH, MANAGEMENT, RIVER-Colorado

Evaluation of stocking 10,000 fin-clipped rainbow trout in the Williams Fork, Eagle, and Colorado Rivers in July 1955. Fish for the evaluation were collected with electrofishing gear until April 1957.

461. Kleinman, A. P., G. J. Barney, and S. G. Titmus. 1974. Economic impacts of changes in salinity levels of the Colorado River. U. S. Bureau of Reclamation, Denver, Colo. 41 pp.

ECONOMICS, RIVER-Colorado, SALINITY

Review of economics as related to increasing salinity levels in the Colorado River.

462. Knight, A. W. 1965. Studies on the stoneflies (Plecoptera) of the Gunnison River Drainage in Colorado. Ph.D. Thesis, Univ. Utah, Salt Lake City. 155 pp.

DISTRIBUTION, ECOLOGY, INVERTEBRATE, RIVER-Gunnison

Summarizes the distribution and habitat preferences of stoneflies in the drainage, with emphasis on ecological factors affecting distribution. Laboratory studies were also made on the effects of waterflow, temperature, and reduced oxygen level. Mortality increased with increased temperature and reduced waterflow for short and extended periods. The nymphs of certain species were able to survive low oxygen levels during intermittent and even extended periods, depending on streamflow and temperature.

463. Knox, R., T. Hickman, D. Langlois, T. Lytle, and J. Torres. 1979. Colorado River cutthroat trout inventory. Colo. Dep. Nat. Resour., Div. Wildl., Denver. Performance Rep., Endangered Wildl. Invest. SE-3-2. 22 pp.

DISTRIBUTION, FISH-rare, RIVER-Colorado

Provides a taxonomic analysis of 53 cutthroat trout in 10 collections that were taken from 8 streams in the Colorado River drainage. Compares this information with taxonomic data from pure populations of the Colorado River cutthroat trout (Salmo clarki pleuriticus).

464. Koehn, R. K. 1969. Hemoglobins of fishes of the genus Catostomus in western North America. Copeia 1969(1): 21-30.

DESCRIPTION, FISH

The hemoglobins of fishes of the subgenera Pantosteus and Catostomus of the genus Catostomus were studied by starch gel electrophoresis, throughout most of their geographic ranges, for interspecific and intraspecific variation. Some differences in less-concentrated electrophoretic hemoglobin components were observed among species of the subgenus Catostomus. Species of the subgenus Pantosteus exhibited a phenotype unlike species of Catostomus, with the exception of Catostomus (Pantosteus) columbianus, which was like members of the subgenus Catostomus in anodal pattern. In addition, cathodal hemoglobin components, which within these species were found to be characteristic of Pantosteus, were absent in some populations of C. columbianus.

465. Kolstad, C. D. 1976. The 1975 energy production system in the states of the Rocky Mountain Region. Los Alamos Sci. Laboratory Energy Systems and Statistics Group, Los Alamos, N. M. 115 pp.

ECONOMICS, ENERGY, MINERAL, POPULATION

Report on the energy-production system of the Rocky Mountain region (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming). Includes information on (1) quantities of energy produced, transported, exported, converted, and consumed; (2) employment in these activities; (3) contributions by these activities to final energy price; and (4) maps of the energy-supply system in each state.

466. Koster, W. J. 1957. Fishes of New Mexico. Univ. New Mexico Press, Albuquerque. 116 pp.

DESCRIPTION, DISTRIBUTION, FISH

Short description of fishes found in New Mexico, including many in the lower Colorado River Basin. Provides some insight into the historical changes in the fish fauna of the Southwest.

467. Koster, W. J. 1960. Ptychocheilus lucius (Cyprinidae) in the San Juan River, New Mexico. Southwest. Nat. 5(3): 174-175.

FISH-rare, LIMNOLOGY, RIVER-San Juan

A report of two Colorado squawfish collected about 3 miles below the town of Rosa, New Mexico, in June and August of 1959. Provides a brief description of the status and habitat of this fish in the San Juan River before the construction of Navajo Dam. Also gives a partial species list of fish in the San Juan River.

468. Kramer, R. H. 1967. Green River fishes and invertebrates. Utah Coop. Fish. Unit, Utah State Univ., Logan. Spec. Rep. 9 pp. (Unpubl. manuscr.)

DISTRIBUTION, FISH, RIVER-Green, SURVEY

Summarizes fish and invertebrate collections made in the Green River in 1963-66. Includes recommendations for further research in the system.

469. Krutilla, J. V. 1975. The use of economics in project evaluation. Trans. N. Am. Wildl. Nat. Resour. Conf. 40: 374-381.

ECONOMICS, MANAGEMENT, RESOURCES

Thesis on the applicability of cost-benefit analysis in evaluating projects, including those in water-resource development.

470. Krutilla, J. V., and O. Eckstein. 1964. Multiple purpose river development: studies in applied economic analysis. John Hopkins Press, Baltimore. 301 pp.

ECONOMICS, MANAGEMENT, PLAN

Summarizes economic studies of multiple-use water development in river basins throughout the United States.

471. LaBounty, J. F., and W. L. Minckley. 1972. Native fishes of the upper Gila River system, New Mexico. Pages 134-146 in Symposium on rare and endangered wildlife of the southwestern United States. New Mexico Department of Game and Fish, Santa Fe.

DISTRIBUTION, FISH, HISTORY, RIVER-Colorado

In about 1900, few non-native fishes were found in the Gila River. However, non-native fish were present in ratios of about 1:1 by 1950, 1.5:1 by 1960 and 2.3:1 by 1972. These changes occurred due to the introduction of species and the elimination of native species.

472. Ladwig, L. R. 1975. Colorado land use laws and engineering geology--a working relationship. Annu. Symp. Eng. Geol. Soils Eng. 13: 211-218.

GEOLOGY, LAW, PLAN, RESOURCE

Reviews two laws that are applicable to all county and municipal planning or zoning boards in locating areas of potential geological hazard.

473. Lane, E. W. 1930. Erosion below dams: a bibliography. U. S. Bureau of Reclamation, Denver, Colo. 3 pp.

BIBLIOGRAPHY, DAM, EROSION

Bibliography of erosion in tailwaters of dams.

474. Langbein, W. B., and D. R. Dawdy. 1964. Occurrence of dissolved solids in the surface waters of the United States. Pages 115-117 in Geological survey research 1964, Chapter D. U. S. Geol. Surv. Prof. Pap. 501D.

STREAMFLOW, WATER QUALITY

Correlates the direct and positive relation of the load of dissolved solids with the amount of runoff. Points out that less than 10% of the total load may be carried in solution in dry areas whereas the percentage may increase to 50 or more in humid areas; also that the dissolved load is commonly less than the suspended load. Includes data on the Colorado River basin.

475. Langlois, D. 1977. Colorado's endangered fish. Colorado Outdoors 26(3): 18-21.

ABUNDANCE, DISTRIBUTION, FISH-rare, RIVER-Colorado

A popular paper describing the status and distribution of fish that are considered to be threatened or endangered in Colorado.

476. Langlois, D., J. Torres, C. Prewitt, E. Wick, C. Carlson, and D. Snyder. 1978. Colorado squawfish and humpback chub population and habitat monitoring program. Colo. Dep. Nat. Resour., Div. Wildl., Denver. Performance Rep., Endangered Wildl. Invest. SE-3-1. 57 pp.

DISTRIBUTION, FISH-rare, HABITAT, RIVER-Colorado, Gunnison, White, Yampa

Provides a summary of collections made in the Colorado, Gunnison, White, and Yampa Rivers for the Colorado squawfish and humpback chub. Documents the condition of the riparian habitat including bankside vegetation, bank stability, and regional land use practices with emphasis on water diversion, return flows, and pollution.

477. Lanigan, S. H., C. R. Berry, Jr., and D. Robinson. 1979. Distribution and abundance of fishes in the White River in Utah. Interim Rep., Contract 14-16-0006-78-0925, U. S. Dep. Int., Bur. Land Manage., Utah State Office, Salt Lake City. 276 pp.

ABUNDANCE, DISTRIBUTION, FISH, FISH-rare, RIVER-White

The fish population of the White River was similar to that in other eastern Utah streams. Red shiners were most abundant, followed by roundtail chubs, flannelmouth suckers, speckled dace, fathead minnows, carp, and channel catfish, in decreasing order. Thirteen adult Colorado squawfish were captured or observed in the lower 12 miles (19 km) of the White River. No juvenile or larval squawfish were found. The sampling was conducted between early June and late September, 1978.

478. LaPray, B. A. 1972. Bibliography of U. S. Geological Survey water-resources reports for Utah. Utah Dep. Nat. Resour. Inf. Bull. 23. 58 pp.

BIBLIOGRAPHY, GEOLOGY, HYDROLOGY, STREAMFLOW, TEMPERATURE, WATER QUALITY

This bibliography contains a complete listing to 31 December 1971 of reports relating to the water resources of Utah, including portions of the Upper Colorado River Basin, prepared by personnel of the U. S. Geological Survey. Discussions of the related subjects of geology, hydrology, and chemical quality of the water are included in many of the reports.

479. LaPray, B. A. 1975. Bibliography of U. S. Geological Survey water-resource reports for Utah. Utah Dep. Nat. Resour., Salt Lake City, Inf. Bull. 23. 58 pp.

BIBLIOGRAPHY, WATER QUALITY, WATER QUANTITY

Contains a complete listing of U. S. Geological Survey reports to 31 December 1974.

480. LaRivers, I. 1962. Fishes and fisheries of Nevada. Nevada State Fish Game Commission, State Printing Office, Carson City. 782 pp.

ABUNDANCE, ALTERATION, DESCRIPTION, DISTRIBUTION, FISH, FISH-rare, FISHERY, FOOD HABITS, LIFE HISTORY, MANAGEMENT, RECREATION, RESOURCES

Thorough discussion of the waters and fisheries found in Nevada, including portions of the Colorado River basin. Includes information on abundance, distribution, and life history of many Colorado river fishes.

481. LaRivers, I., and T. J. Trelease. 1952. An annotated checklist of the fishes of Nevada. Calif. Fish Game 38(1): 113-123.

ABUNDANCE, DESCRIPTION, DISTRIBUTION, FISH, MANAGEMENT

A list of introduced and native fishes found in Nevada, with a short description of each species and its distribution throughout the state.

482. Larsen, W. P. 1952. The dragon flies (Anisoptera) of Utah. M. S. Thesis, Univ. Utah, Salt Lake City. 95 pp.

INSECT, KEYS

Provides a key to the species found in Utah, with brief information of their distribution and biology.

483. LaRue, E. C. 1916. Colorado River and its utilization. U. S. Geol. Surv. Water-Supply Pap. 395. 231 pp.

HISTORY, RESERVOIR, RIVER-Colorado, Dolores, Green, Gunnison, Little Snake, San Juan, San Rafael, White, Yampa

A comprehensive description of the Colorado River basin: physical features, history, population, water supply, discharge records, irrigation, diversion, potential storage sites, and siltation; 25 photographic plates of river scenes.

484. LaRue, E. C. 1925. Water power and flood control of Colorado River below Green River, Utah. U. S. Geol. Surv. Water-Supply Pap. 556. 176 pp.

FLOOD, MANAGEMENT, POWER, RECLAMATION, RIVER-Colorado

Summarizes the availability of water for irrigation, water power, industrial processes, and municipal supplies. Includes reservoir sites in the headwaters and the main stem where reservoirs have been built, and provides an outline for prospective sites for future development. Also summarizes the problems associated with floods on this river and provides information on reservoir sites that might be used in flood control. Appendices on the geology of this area relate to river development.

485. Law, J. P., and G. V. Skogerboe. 1972. Potential for controlling quality of irrigation return flows. J. Environ. Res. 1(2): 140-145.

IRRIGATION, STREAMFLOW, WATER QUALITY

Provides information on factors that influence the quality of return flows from irrigation and discusses the potential for improvement.

486. Law, J. P., and J. L. Witherow, editors. 1970. Water quality management problems in arid regions. Treatment and Control Research Program, Robert S. Kerr Water Research Center, Ada, Oklahoma. 110 pp.

MANAGEMENT, WATER QUALITY

Report with a selected group of papers on water quality management problems in arid regions.

487. Lawrence, K. 1974. The political and legal aspects of streamflows in Colorado. Boulder, Colorado, in cooperation with the Denver Water Board on the Western Interstate Commission for Higher Eduction. 76 pp.

LAW, POLICY, STREAMFLOW

A concise but fairly comprehensive reference on the political and legal aspects of streamflow. Offers recommendations concerning various interests in streamflows that must be incorporated into different laws to maximize the use of water in arid areas.

488. Leaf, C. F. 1971. Areal snow cover and disposition of snowmelt runoff in central Colorado. U. S. For. Serv. Res. Pap. RM-66. 19 pp.

HYDROLOGY, STREAMFLOW, WATER QUANTITY

Fourteen years of comparative streamflow (Fraser Experimental Forest, Colorado) indicated that water yields from a low-elevation drainage (9,850 feet) can vary from near zero in poor runoff years to a maximum of about 50% during good years, when compared with the flow generated from a higher elevation drainage.

489. Leaf, C. F. 1975. Watershed management in the central and southern Rocky Mountains: a summary of the status of our knowledge by vegetation types. U. S. For. Serv. Res. Pap. RM-142. 28 pp.

CLIMATE, HYDROLOGY, MANAGEMENT, PRECIPITATION, RUNOFF, SNOWPACK, VEGETATION, WATERSHED.

Summarizes a series of comprehensive reports on watershed management in five major vegetation zones: (1) the coniferous forest subalpine zone; (2) the Front Range ponderosa pine zone; (3) the Black Hills ponderosa pine zone; (4) the alpine zone; and (5) the big sagebrush zone. Includes what is known about the hydrology of these lands, what hydrologic principles are important for multi-resource management, and what additional information is needed for each vegetation type.

490. Leaf, C. F. 1975. Watershed management in the Rocky Mountain subalpine zone; the status of our knowledge. U. S. For. Serv. Res. Pap. RM-137. 31 pp.

CLIMATE, HYDROLOGY, MANAGEMENT, PRECIPITATION, RUNOFF, SNOWPACK, WATERSHED

Reviews field studies on the effects of watershed management practices on snow accumulation, melt, and runoff. Simulation models predict the hydrologic impacts of timber harvesting and weather modification. Highlights research needs and summarizes guidelines for implementing watershed management principles to land use planning.

491. Leaming, G. F. 1971. Minerals in the economic development of the Four Corners region: a summary report. Div. Econ. Bus. Res., Coll. Bus. Public Admin., Univ. Arizona, Tucson. 55 pp.

ECONOMICS, MINERAL, RESOURCES

A summary and selected bibliography which lists and discusses all minerals and the problems to be encountered in their development in the Four Corners area of Utah, Colorado, Arizona, and New Mexico. Discusses political, economic, environmental, and other considerations.

492. Leaming, G. F., R. C. Moore II, N. de Gennaro, and H. Frank. 1971. Minerals in the economic development of the Four Corners region. Div. Econ. Bus. Res., Coll. Bus. Publ. Admin., Univ. Arizona, Tucson. 649 pp.

ECONOMICS, MINERAL, RESOURCES

Lists and discusses all minerals and the problems to be encountered in their development in the Four Corners area of Utah, Colorado, Arizona, and New Mexico. Discusses political, economic, environmental, and other considerations.

493. Lemons, D. G. 1954. A field survey of western Colorado streams and lakes. Colorado Dep. Game and Fish, Denver. 29 pp.

DISTRIBUTION, FISH, RIVER-Colorado, Dolores, Gunnison, San Juan, Yampa, and others, SURVEY

Survey describing the physical characteristics of some streams and lakes of western Colorado and providing information on the presence of fish.

494. Lemons, D. G. 1955. Channel cat study. Colorado Dep. Game Fish and Parks, Denver. Proj. 121. 9 pp.

AGE-GROWTH, FISH, FOOD HABITS, RIVER-Colorado, Dolores, San Juan, White, Yampa

Compares the age, growth, and food of channel catfish in Colorado waters of the Colorado, Dolores, San Juan, White, and Yampa Rivers.

495. Leopold, L. B. 1969. Quantitative comparision of some aesthetic factors among rivers. U. S. Geol. Surv. Circ. 620. 16 pp.

RECREATION, RIVER-Colorado, STREAMFLOW

Describes a quantitative method to compare aesthetic factors of 12 sites in Idaho; also compares these factors for the Colorado River in the Grand Canyon.

496. Leversidge, F. J., editor. Priorities in water management. Dep. Geogr., Univ. Victoria, British Columbia, West. Geogr. Ser., Vol. 8. 300 pp.

ECONOMICS, LAW, MANAGEMENT, POLICY

Examines the environmental impact of large-scale river diversions and impoundments, explores "planned" benefits and costs with those actually realized in operating projects, and discusses the management of water quality in impoundments.

497. Livesay, J., A. Regenthal, J. Varley, D. Dufek, F. W. Jackson, and R. Wiley. 1969. Green River and Flaming Gorge Reservoir post-impoundment investigations. Joint Rep., Utah Div. Fish Game, Salt Lake City, and Wyo. Game Fish Comm., Cheyenne. Prog. Rep. 6. 26 pp.

FISH, MANAGEMENT, RIVER-Green, SURVEY

Describes a survey of the limnology and fishery of Green River and Flaming Gorge Reservoir in 1969.

498. Lloyd, E., And P. A. Rechard. 1957. Compacts, treaties, and court decrees. Wyoming State Engineer, Cheyenne, Wyo. 133 pp.

LAW, POLICY, WATER QUANTITY

Documents the use and control of Wyoming's interstate streams.

499. Lohman, S. W. 1965. Geology and artesian water supply of the Grand Junction area, Colorado. U. S. Geol. Surv. Prof. Pap. 451. 149 pp. + maps.

GEOLOGY, GROUNDWATER, HYDROLOGY, RIVER-Colorado, Gunnison

The purpose of this study was to determine the locations, depths, and yields of the wells, hydrologic properties of the aquifers, chemical quality of the water, and degree of interference between wells. It also includes studies of the recharge conditions and areas of outcrop of the several aquifers.

500. Longenbaugh, R. A. 1976. Data retrieval considerations. Pages 408-414 in J. F. Orsborn and C. H. Allman, editors. Proceedings, Symposium and specialty conference, instream flow needs, Vol. II, Am. Fish. Soc., Washington, D. C.

CLIMATE, LAW, MANAGEMENT, RECLAMATION, RESERVOIR, RIVER-Colorado, WATER QUALITY

Emphasizes considerations to be applied to data retrieval systems with a description of the Colorado water data bank and a summary of the kinds of information that can be retrieved from this bank.

501. Longwell, C. R. 1946. How old is the Colorado River? Am. J. Sci. 244: 817-835.

GEOLOGY

An analysis of the evidence which placed the origin of the Colorado River in the late Miocene or early Pliocene.

502. Lord, W. B. 1980. Institutional aspects of water allocation in the upper Colorado River basin: implications for fish and wildlife. Chapter 16 in W. O. Spofford Jr., A. L. Parker, and A. V. Kneese, eds. Energy development and the water, fish, and wildlife in the Southwest: Problems of the upper Colorado River basin. Resources for the Future, Washington, D. C. In press.

LAW, MANAGEMENT, POLICY, RIVER-Colorado, WATER RESOURCE

Addresses some of the institutional and legal issues of the land and water resources of the upper Colorado River basin. Also describes the political, administrative, and other social institutions for water allocation in the upper basin and how the doctrine of prior appropriations has been used in the West as contrasted with riparian water rights.

503. Lower Colorado River Advisory Committee. 1964. The lower Colorado River land use plan. Lower Colorado River Land Use Advisory Commission, Box 1648, Yuma, Ariz. 187 pp.

ECONOMICS, PLAN, POLICY, RIVER-Colorado, WATER QUANTITY

A general land use plan that includes the lower Colorado River and the resources on both sides of the river for various distances.

504. Lowham, H. W., L. L. DeLong, K. D. Peter, D. J. Wangsness, W. J. Head, and B. H. Ringen. 1976. A plan for study of water and its relation to economic development in the Green River and Great Divide Basins in Wyoming. U. S. Geol. Surv., Cheyenne, Wyo. Open-file Rep. 76-349. 99 pp.

ECONOMICS, GEOLOGY, HYDROLOGY, RIVER-Green, SALINITY, SEDIMENT, STREAMFLOW

Summarizes the U. S. Geological Survey hydrologic study plan of the Green River and Great Divide Basins in Wyoming; discusses water resources and develops predictive methods for describing future conditions; includes information on trace metals, biological characteristics, and salinity trends.

505. Lucchitta, I. 1972. Early history of the Colorado River in the Basin and Range province. Geol. Soc. Am. Bull. 83: 1933-1948.

GEOLOGY, HISTORY

An interpretation of the geologic history of the Colorado River in the Basin and Range provinces. Hypotheses are drawn concerning the formation of the Imperial Valley, the Parker-Blythe-Cibola area, the Lake Mead Area, and the Hualapai Plateau.

506. Luce, C. F., chairman. 1973. Water policies for the future. National Water Commission, Water Information Center, Inc., Port Washington, N. Y. 579 pp.

MANAGEMENT, POLICY

A final report to the President and Congress of the United States by the National Water Commission, giving conclusions and recommendations on policies for efficient, equitable, and environmentally responsible management of water resources.

507. Lusby, G. C. 1965. Causes of variation in runoff and sediment load from small drainage basins in western Colorado. Pages 94-98 in Proceedings of the Federal Interagency Sedimentation Conference, 1963. U. S. Dep.Agric., Agric. Res. Serv. Misc. Publ. 970.

RIVER-Colorado, SEDIMENT

During a study of the effects of grazing on runoff, sediment yield, vegetation, and infiltration rates in paired, grazed and ungrazed drainage basins in the Badger Wash area (lying northwest of Grand Junction, Colorado, and draining into the Colorado River), it was determined that runoff and sediment yield were considerably less in the ungrazed basin at each pair.

508. Lusby, G. C. 1970. Hydrologic and biotic effects of grazing vs. non-grazing near Grand Junction, Colorado. J. Range Manage. 23(4): 256-260. (Also published in U. S. Geol. Surv. Prof. Pap. 700-B: 232-236.)

ECOLOGY, GRAZING, HYDROLOGY, RIVER-Colorado, RUNOFF

In studies of the effects of grazing on salt-desert shrub vegetation in Western Colorado, ungrazed watersheds had 30% less runoff than did grazed watersheds. In 1953-63 sediment yield on catchment reservoirs averaged 45% less from ungrazed than from grazed watersheds. Over the same period, on grazed watersheds (compared with ungrazed watersheds), ground cover decreased and bare cover and rock increased.

509. Lusby, G. C., V. H. Reid, and O. D. Knipe. 1971. Effects of grazing on the hydrology and biology of the Badger Wash Basin in western Colorado, 1953-66. U. S. Geol. Surv. Water-Supply Pap. 1532-D. 90 pp. + map.

AGRICULTURE, ALTERATION, GRAZING, HYDROLOGY, RUNOFF, VEGETATION, WATER QUALITY

For the period 1954-66, runoff from grazed watersheds averaged about 33 acre-feet per square mile per year. Runoff from ungrazed watersheds averaged 71 to 76% of that amount, although this percentage fell to 67-71% during the last 6 years of the period. The sediment yield from grazed watersheds during the same period was about 3 acre-feet per square mile per year; the yield from ungrazed watersheds ranged from 51 to 75% of that amount and averaged 66%. The largest change in these relations occurred about 2 years after livestock were excluded from certain watersheds. After 13 years, a significant change had occurred in the amount of bare rock, in the ground cover index, and in the litter and moss on the grazed watersheds, but not on the ungrazed ones.

510. Lusby, G. C., G. T. Turner, J. R. Thompson, and V. H. Reid. 1963. Hydrologic and biotic characteristics of grazed and ungrazed watersheds of the Badger Wash Basin in Western Colorado, 1953-58. U. S. Geol. Surv. Water-Supply Pap. 1532-B. 73 pp.

AGRICULTURE, ALTERATION, HYDROLOGY, VEGETATION

Presents data compiled in the first quarter of a 20-year comprehensive study of the hydrologic and biotic characteristics of small Colorado Plateau drainage basins and the effect of grazing on these characteristics. Periodic observations were made at permanent transects in eight paired fenced and unfenced watersheds to characterize the plant and ground cover, determine degree of use by livestock, and measure changes in watershed cover. Trends of small mammal populations were also observed.

511. Lutey, J. M. 1980. Habitat evaluation procedures (HEP). Chapter 15 in W. O. Spofford Jr., A. L. Parker, and A. V. Kneese, editors. Energy development and the water, fish, and wildlife in the Southwest: Problems of the upper Colorado River basin. Resources for the Future, Washington, D. C. In press.

FISH, HABITAT, PLAN, WILDLIFE

Describes the habitat evaluation procedures developed by the U. S. Fish and Wildlife Service, state conservation agencies, and private conservation agencies to provide a uniform, nationwide method for assessing the impacts on fish and wildlife and their habits from water development projects. The evaluation is based on a relative rating scale and establishes a base for identifying measures needed to compensate for fish and wildlife habitat loss.

512. Lynch, T. M. 1957. A theorem for warm water classification. Colo. Game Fish Dep., Denver. Prog. Rep., Proj. 7A. 9 pp.

DESCRIPTION, HYDROLOGY, MANAGEMENT, TEMPERATURE, WATER QUALITY

Development of criteria for classification of Colorado lakes and reservoirs.

513. Lynch, T. M. 1957. Compiled growth data on warmwater fish species. Colo. Game Fish Dep., Denver. Prog. Rep., Proj. 15A. 16 pp.

AGE-GROWTH, FISH, RIVER-Colorado, Dolores, San Juan, White, Yampa

An assemblage of water records and reports compiled into a single report of age and growth studies for 14 warmwater species of Colorado; includes limited information on species of the upper Colorado drainage, especially channel catfish in the Dolores, San Juan, Yampa, White, and Colorado Rivers.

514. Lynch, T. M. 1975. 1974 fish hatchery distribution report. Colorado Division of Wildlife, Denver. 50 pp.

FISH, MANAGEMENT

Compilation of data for annual fish distribution by type of fish (coldwater, warmwater, county, region, drainage, and land type for fish under 3 inches, 3-6 inches, and over 6 inches long). Available for other years since at least 1965.

515. Lynch, T. M. 1975. 1974 wildlife conservation officers creel census report. Colorado Division of Wildlife, Denver. 16 pp.

FISH, MANAGEMENT

Summary of creel census by region (NE, SE, NW, SW) and species, providing the number of waters checked, number of fishermen checked, and catch statistics. Creel census reports are available since 1940.

516. Lynch, T. M., S. Bessire, and J. Gray. 1950. Elementary survey of Dolores River, from Utah line to Paradox Valley, Colorado. Colorado Dep. of Game and Fish, Denver. 3 pp.

FISH, RIVER-Dolores, SURVEY

Survey of the Dolores River with descriptive information of the river. Emphasis was placed on the channel catfish.

517. Lynch, T. M., and D. G. Lemons. 1956. The age, growth and weight relationships of channel catfish (Ictalurus punctatus) collected from Colorado waters. Colorado Dep. of Game and Fish, Denver. 15 pp.

ABUNDANCE, AGE-GROWTH, DISTRIBUTION, FISH

Comparative data on channel catfish in the waters of Colorado.

518. Mackenthun, K. M., editor. 1967. Temperature and aquatic life. U. S. Fed. Water Pollut. Control Admin., Cincinnati, Ohio, Lab. Invest. Ser. 6. 151 pp.

BIBLIOGRAPHY, FISH, INVERTEBRATE, TEMPERATURE

Literature review and bibliography on the effects of temperature on aquatic life.

519. Maddock, T., III., and N. C. Matalas. 1980. The potential impacts of energy development on the water resources in the Yampa River basin. Chapter 13 in W. O. Spofford Jr., A. L. Parker, and A. V. Kneese, editors. Energy development and the water, fish, and wildlife in the Southwest: Problems of the upper Colorado River basin. Resources for the Future, Washington, D. C. In press.

ENERGY, RIVER-Yampa, WATER RESOURCE

Discusses the problems that are inherent in water resources planning with respect to large-scale energy development. The Yampa River basin was used to illustrate the discussion because of the large coal reserves that are found in the basin. The paper also considers the potential impact of water consumption in coal conversion processes on the streamflow of the Yampa River.

520. Madison, R. J. 1970. Water-quality data for the Flaming Gorge Reservoir area, Utah and Wyoming. U. S. Geol. Surv. Utah Basic-Data Release 20. 33 pp.

RESERVOIR, RIVER-Green, STREAMFLOW, WATER QUALITY

Discusses the load of dissolved ions in the reservoir, the changes in chemical quality of the water as a result of initial leaching and later storage, and the effect of the reservoir on the effluent waters.

521. Madison, R. J., and K. M. Waddell. 1973. Chemical quality of surface water in the Flaming Gorge Reservoir area, Wyoming and Utah. U. S. Geol. Surv. Water Supply Pap. 2009-C. 18 pp. + plates.

RIVER-Green, WATER QUALITY

Impoundment of water in Flaming Gorge Reservoir during the 1963-68 water years caused the concentration of dissolved solids in the river system to increase by 130 mg/1, or about 32% over the probable concentration that would have occurred without the reservoir. Evaporation accounted for an increase of 15 mg/1, and leaching for 115 mg/1.

522. Madsden, M. J. 1958. General survey of water pollution in Utah. Utah Div. Wildl. Resour., Inform. Bull. 61-9. 29 pp. + appendix.

POLLUTION, RIVER-Colorado, Green, Duchesne, Price, San Juan, White, SURVEY, WATER QUALITY

Survey of domestic and industrial pollution in Utah waters during 1 June to 1 October 1958. Various streams in the Colorado River basin were included in this broad survey.

523. Mahoney, J. R. 1964. Navigability of the Green River; management of its waters for resource development. Univ. Utah, Bur. Econ. Bus. Res., Coll. Bus., Salt Lake City. 86 pp.

ECONOMICS, MANAGEMENT, RESOURCE, RIVER-Colorado, Green, TRANSPORTATION

Reviews the potential for navigational and industrial use development of water resources of the Green and Colorado Rivers.

524. Mangan, G. F., and H. A. Swenson. 1972. Urban water planning--a bibliography. U. S. Office of Water Resources Research, Washington, D. C. 369 pp.

BIBLIOGRAPHY, PLAN, WATER QUANTITY

Bibliography on the planning and management of urban water supplies.

525. Mangum, F. A. 1975. Analysis of macroinvertebrate samples from ten Rocky Mountain streams. Ph. D. Thesis, Brigham Young Univ., Provo, Utah. 272 pp.

ABUNDANCE, DISTRIBUTION, INVERTEBRATE

Data analysis includes three diversity indices, a numerical taxonomy system of multivariate statistical analysis, numbers and biomass by selected organisms, percent composition to taxonomic order, and total numbers and biomass. Effects of siltation and altered flows were demonstrated.

526. Mann, D., G. Weatherford, and P. Nichols. 1974. Legal-political history of water resource development in the Upper Colorado River Basin. Univ. Calif., Inst. Geophys., Lake Powell Res. Proj. Bull. 4. 53 pp.

HISTORY, LAW, MANAGEMENT, RECLAMATION, RIVER-Colorado

Reviews the history of water resource development of the upper Colorado River as related to law and politics.

527. Mann, D. E. 1976. Water policy and decision-making in the Colorado River Basin. Univ. Calif., Inst. Geophys., Lake Powell Res. Proj. Bull. 24. 40 pp.

POLICY, RIVER-Colorado, WATER RESOURCE

Discusses the factors that influence decisions regarding water policy in the Colorado River basin.

528. Markofsky, M., and D. R. F. Harleman. 1971. Predictive model for thermal stratification and water quality in reservoirs. U. S. Environ. Prot. Agency, Water Pollut. Control Res. Ser. 16/30 DJH 01/71. 283 pp.

LIMNOLOGY, MODEL, RESERVOIR, TEMPERATURE, WATER QUALITY

Provides a model capable of predicting water temperature and quality in reservoirs.

529. Marlatt, W. E., and H. Reihl. 1963. Precipitation regimes over the upper Colorado River. J. Geophys. Res. 8(24): 6447-6458.

CLIMATE, PRECIPITATION, RIVER-Colorado and tributaries, STREAMFLOW

Daily precipitation values recorded at weather stations in the basin were summed with an area weighting method to yield a daily mean basin value. A good correlation was obtained between computed annual precipitation and annual river discharge--50% of the annual precipitation is produced on 16% of the total number of days on which precipitation occurs.

530. Martin, R. O. R., and R. L. Hanson. 1966. Reservoirs in the United States. U. S. Geol. Surv. Water Supply Pap. 1838. 115 pp.

RESERVOIR, WATER QUANTITY

Summarizes storage capacity and related data of 1,563 reservoirs and controlled natural lakes in the United States. Data are for storage facilities with a usable capacity of 5000 acre-feet or more that were completed or under construction as of 1 January 1963.

531. Matthews, W. J., and L. G. Hill. 1979. Influence of physico-chemical factors on habitat selection by red shiners, Notropis lutrensis (Pisces: Cyprinidae). Copeia 1979(1): 70-81.

FISH, HABITAT, LIFE HISTORY, LIMNOLOGY

Temperature, water velocity, and water depth had the greatest impact on habitat selection of this species. Gradients of total dissolved solids or pH can markedly influence habitat selection by red shiners; dissolved oxygen, turbidity, shelter, shade and substrate are apparently of lesser importance. Red shiners avoided temperature extremes in winter and summer, and consistently selected water deeper than 20 cm with negligible flow. Shiners avoided unsheltered locations and clean, unstable sand substrate but did not exhibit a consistent response to turbidity or shade. (This species is becoming abundant in the upper Colorado River.)

532. Maxwell, J. D., B. L. Bridges, D. A. Barker, and L. G. Moore. 1971. Hydrogeology of the eastern portion of the south slope of the Uinta Mountains, Utah. Utah Dep. Nat. Resour., Inf. Bull 21. 54 pp.

GEOLOGY, GROUNDWATER, HYDROLOGY, RIVER-Green

Briefly summarizes investigations to determine the relation between the many springs and sinks in the eastern part of the Uinta Basin.

533. May, B., and D. Hepworth. 1975. Lake Powell post-impoundment investigations: annual progress report, 1974-1975. Utah Div. Wildl. Resour., Salt Lake City, Publ. 76-3. 42 pp.

FISH, LIMNOLOGY, MANAGEMENT, RESERVOIR, RIVER-Colorado

Describes a survey of the limnology and fishery of Lake Powell in 1975.

534. May, B. E. 1970. Biota and chemistry of Piceance Creek. M. S. Thesis, Colorado State Univ., Fort Collins. 152 pp.

FISH, FISH-rare, INVERTEBRATE, RIVER-White, WATER QUALITY

Detailed summary of the species composition, number, volume, and weight of macroinvertebrates in each of 2 years (1968-69) in Piceance Creek, a tributary of the White River. Data on water chemistry of this stream, and a list of fish species sampled in Piceance Creek and in the White River are also included. Reports collection of Colorado squawfish from the White River.

535. May, B. E. 1973. Seasonal depth distribution of rainbow trout (*Salmo gairdneri*) in Lake Powell. Proc. Utah Acad. Sci. Arts. Lett. 50 (Part 2): 64-72.

DISTRIBUTION, FISH, LIMNOLOGY, RESERVOIR, RIVER-Colorado

Summarizes the distribution of rainbow trout in Lake Powell as related to the limnology of the reservoir.

536. May, B. E., D. K. Hepworth, V. Starostka, and S. P. Gloss. 1975. Impact of threadfin shad introduction on food habits and growth of rainbow trout in Lake Powell, Utah. Proc. Annu. Conf. West. Assoc. State Game Fish Comm. 55: 228-248.

FISH, FOOD HABITS, RESERVOIR, RIVER-Colorado

Describes the utilization of threadfin shad as forage for rainbow trout in Lake Powell.

537. May, B. E., and C. Thompson. 1974. Impact of threadfin shad (*Dorosoma petenense*) introduction on food habits of four centrarchids in Lake Powell. Proc. Annu. Conf. West. Assoc. State Game Fish Comm. 54: 317-344.

FISH, FISHERY, FOOD HABITS, RIVER-Colorado

Food of largemouth bass, black crappies, bluegills, and green sunfish was altered substantially after the introduction of threadfin shad. Seasonal variation in centrarchid diets was reduced as shad became the main food item. Diets of small and large bass and crappies differed significantly before shad were introduced; small fish generally fed on zooplankton and insects, and larger ones included fish in their diets. After the introduction of shad, bass and crappies of all size groups relied heavily on them for forage.

538. May, B. E., C. Thompson, and S. P. Gloss. 1975. Impact of threadfin shad (*Dorosoma petenense*) introduction on food habits of four centrarchids. Utah Div. Wildl. Resources, Publ. 75-4. 22 pp.

FISH, FOOD HABITS, RESERVOIR, RIVER-Colorado

Food of largemouth bass, black crappies, bluegills, and green sunfish was changed substantially after the introduction of threadfin shad into Lake Powell. Marked differences occurred in the diets of various size groups of bass and crappies before shad were introduced into the reservoir. Small fish generally fed on zooplankton and insects, and larger individuals included fish in their diets. After the introduction of the threadfin shad, all size groups of both species fed heavily on shad.

539. May, B. E., J. D. Leppink, and R. S. Wydoski. 1978. Distribution, systematics, and biology of the Bonneville cutthroat trout, Salmo clarki utah. Utah State Div. Wildl. Resources, Salt Lake City, Publ. 78-15. 24 pp.

ABUNDANCE, AGE-GROWTH, DISTRIBUTION, FISH-rare, FOOD HABITS

Summarizes the historical and present distribution of the Bonneville cutthroat trout. At present, only relic populations of this subspecies have been located in a few small isolated streams in Utah, Wyoming, and Nevada. Also provides a synthesis of the primary morphological characters of S. c. utah and aspects of its biology (food habits, age and growth, and reproduction). Discusses management implications for this unique, rare subspecies of cutthroat trout.

540. McAda, C. W. 1977. Aspects of the life history of three catostomids native to the upper Colorado River Basin. M. S. Thesis, Utah State Univ., Logan. 117 pp.

ABUNDANCE, AGE-GROWTH, DISTRIBUTION, ECOLOGY, FISH, FISH-rare, FOOD HABITS, HABITAT, HISTORY, LIFE HISTORY, MOVEMENT, RIVER-Colorado, Green, Yampa

Provides new biological information and synthesizes all known life history information on the razorback sucker, flannelmouth sucker, and bluehead sucker. Emphasis was placed on the razorback sucker because the populations of this species have declined drastically and the species has been proposed for listing under the Endangered Species Act of 1973 as "threatened." Compares aspects of the life history of these three catostomids from two main reaches of the upper Colorado River - the Green and Yampa Rivers in the vicinity of Dinosaur National Monument and the Colorado River near Grand Junction, Colorado.

541. McAda, C. W. 1978. A catalog of water development in the upper Colorado River Basin. U. S. Dep. Inter., Fish Wildl. Serv., Salt Lake City, Utah. 226 pp. + 38 maps.

IRRIGATION, RECLAMATION, RIVER-Colorado

Provides a catalog of water development projects in the upper Colorado River Basin that is planned to be updated on an annual or biannual basis. Each project contains information on the location, sponsor, type of facility, status, physical components, projected impacts, and persons to contact regarding the project.

542. McAda, C., C. Philips, C. R. Berry, Sr., and R. S. Wydoski. 1977. A survey of threatened and endangered fish in southeastern Utah streams. Final Rep., Contract 77-8236, Utah Div. Wildl. Resources, Salt Lake City. Utah Coop. Fish Res. Unit, Utah State Univ., Logan. 245 pp.

ABUNDANCE, DISTRIBUTION, FISH, FISH-rare, RIVER-Colorado

Historical data on fish distribution in southeastern Utah indicated that rare fish species were found only in the Green and Colorado Rivers (Colorado squawfish, humpback chub, humpback sucker, bonytail chub) and Virgin River (Virgin River spinedace, woundfin, Virgin River roundtail chub). Field sampling in 1977 did not extend the known range of any rare fish. The life history of each rare fish species was summarized and the range of each was depicted on Bureau of Land Management land status maps. Lists and relative abundance of other fish species were also compiled from the sampling that was done during 1977. The report also contains information on the macroinvertebrates, water quality, and streamflow.

543. McAda, C., and K. Seethaler. 1975. Investigations of the movements and ecological requirements of the Colorado squawfish and humpback sucker in the Yampa and Green Rivers. Progress Report (1 June 1974 through 31 October 1975), Utah Coop. Fish. Res. Unit., Utah State Univ., Logan, U. S. Fish Wildl. Serv. Contract 14-16-0008-1140. 38 pp.

ECOLOGY, FISH, FISH-rare, LIFE HISTORY, MOVEMENT, RIVER-Green, Yampa

Progress report on a study related to the ecology and movements of the Colorado squawfish and humpback sucker in the Yampa and Green Rivers.

544. McAllister, D. M., editor. 1973. Environment: a new focus for land use planning. Natural Science Foundation, Washington, D. C. 328 pp.

ECOLOGY, ECONOMICS, HISTORY, LAW, MANAGEMENT, POLICY

A task force report sponsored by the National Science Foundation's "RANN-Research Applied to National Needs" on land-use planning. It contains recommendations of high-priority research for land use planning, and other papers concerning the social, economic, and natural environmental factors important to land-use planning.

545. McCloskey, M. 1973. Alternatives in water project planning: ecological and environmental considerations. Pages 425-437 _in_ C. R. Goldman, J. McEvoy III, and P. J. Richerson, eds. Environmental quality and water development. W. H. Freeman and Co., San Francisco.

AESTHETICS, ECOLOGY, MANAGEMENT, PLAN, RECLAMATION

Recommends that planning consist of three components: engineering aspects, economic evaluations, and judgment of aesthetic values to be gained or lost, for a balance between development and maintenance of environmental quality.

546. McCool, S. F., L. E. Royer, J. J. Kennedy, and J. D. Hunt. 1974. Recreational use and management problems on Utah's wild rivers. Proc. Utah Acad. Sci. Arts and Lett. 51(1): 109-115.

MANAGEMENT, RECREATION, RIVER-Colorado, Green, Yampa

Discusses the problems of increasing recreational use on the large rivers of the Upper Colorado River Basin.

547. McDonald, D. B. 1958. Fish stomach contents from samples taken during Colorado River Expedition, 1958. Pages 201-202 (Appendix C) _in_ Charles E. Dibble, ed. Ecological studies of the flora and fauna in Glen Canyon. Univ. Utah Anthropol. Pap. 40, Glen Canyon Ser. 7.

FISH, RIVER-Colorado

Provides information on stomach contents of fish collected from Glen Canyon area on the Colorado River in 1958.

548. McDonald, D. B., and P. A. Dotson. 1960. Fishery investigations of the Glen Canyon and Flaming Gorge impoundment areas. Utah Dep. Fish Game, Salt Lake City, Inf. Bull. 60-3. 70 pp.

ABUNDANCE, DISTRIBUTION, FISH, FOOD HABITS, INVERTEBRATE, RIVER-Colorado, Green

Describes the fish, insect, and plant species present, limnology, and use of the Colorado and Green Rivers before the completion of Flaming Gorge and Glen Canyon impoundments.

549. McGinnies, W. G., B. J. Goldman, and P. Paylove. 1968. Deserts of the world: an appraisal of research into their physical and biological environments. Univ. Arizona Press, Tucson. 788 pp.

DESCRIPTION, ECOLOGY, GROUNDWATER, PLAN, SOIL

Intended to provide information and recommendations for planning, managing, and executing research or development efforts on arid areas, including the North American deserts of Utah, Wyoming, and western Colorado.

550. McKean, W. T. and W. T. Burkhard. 1978. Fish and wildlife analysis for the Yellow Jacket Project. Colo. Dep. Nat. Resour., Div. Wildl., Denver. 543 pp.

FISH, FISH-rare, RESOURCES, RIVER-White, Yampa, WATER QUALITY, WILDLIFE

Describes the fish and wildlife resources and habitat in the Yellow Jacket Project area located in northwestern Colorado. The purpose of the Yellow Jacket Project is to regulate streamflows of the North Fork of the White River and several of the tributaries to the main White River, as well as of Milk Creek, a tributary to the Yampa River. The proposed developments on these streams by the U. S. Bureau of Reclamation would provide water for industrial, municipal, and domestic use in connection with anticipated development of local coal and oil shale reserves.

551. McKee, E. D., R. F. Wilson, W. J. Breed, and C. S. Breed, editors. 1967. Evolution of the Colorado River in Arizona. Museum of Northern Arizona, Flagstaff. 67 pp. + foldout table.

GEOLOGY, HISTORY, RIVER-Colorado

A hypothesis developed at the Symposium on Cenozoic Geology of the Colorado Plateau in Arizona, August 1964, that explains the changes of the Colorado River and formation of the present Grand Canyon that divides the upper and lower basins.

552. McKell, C. J., director. 1972. Intermountain universities' conference on policy formulation in the development of energy resource. Proceedings. The Salt Palace, Salt Lake City, Utah. 24-25 May 1972. 159 pp.

ECOLOGY, ECONOMICS, ENERGY, GEOLOGY, LAW, POWER RESOURCES, SOCIOLOGY

This compilation of papers presented at a discussion of the formation of policies for the development of energy resources includes topics such as requirements and geography of energy; the technology of energy; economic, legal, and sociological aspects of the development of energy resources; and the environmental effects of alternative energy resource development.

553. McKell, C. M., director. 1972. Intermountain universities' conference on policy formulation in the development of energy resources. Research needs statements. The Salt Palace, Salt Lake City, Utah, 24-25 May 1972. 25 pp.

ECOLOGY, ECONOMICS, ENERGY, GEOLOGY, LAW, POWER, RESOURCES, SOCIOLOGY

A compilation of follow-up statements on needed research in energy development. Topics discussed included energy requirements and geography of resources; technology for extraction of resources; economic, sociological, and legal aspects of resource development; and environmental impacts of alternative courses of action.

554. McLean, J. E., chairman. 1965. Symposium in streamflow regulation for quality control. U. S. Dep. Health Educ. Welfare, Public Health Serv., Publ. 999-WP-30. 420 pp.

MANAGEMENT, STREAMFLOW, WATER QUALITY

Summary of a symposium on regulating streamflow to control water quality in downstream reaches.

555. McNickle, R. K. 1963. Water: development, utilization, conservation. Western Resources Paper, Univ. Colorado Press, Boulder. 244 pp.

ECONOMICS, IRRIGATION, MANAGEMENT, POLICY

Discusses the many aspects of water development--municipal, recreational, agricultural, etc.--involved in the decision-making process.

556. McWhorter, D. B., R. K. Skogerboe, and G. V. Skogerboe. 1975. Water quality control in mine spoils upper Colorado River Basin. Environ. Prot. Agency Tech. Ser. EPA-ROAP-21BDU-02, and Natl. Tech. Inf. Serv., Springfield, Va., PB-242 908/2ST. 110 pp.

GROUNDWATER, POLLUTION, RIVER-Colorado, WATER QUALITY

Identifies potential water quality problems associated with runoff and percolation through mine spoils at selected sites in the Upper Colorado River Basin. Shows that the production of soluble salts from mine spoils into receiving waters is probably the most significant water quality problem that can be expected. No significant release of heavy metals was observed in the coal mine spoils studied.

557. Medine, A. J., D. B. Porcella, and P. A. Cowan. 1977. Microcosm dynamics and response to heavy metal loading in a Lake Powell sediment-water-gas ecosystem. Final Rep. Southern California Edison Co. Contract U0966901. Utah State Univ., Logan. 131 pp.

LIMNOLOGY, MINERAL, POLLUTION, RESERVOIR, RIVER-Colorado

The levels of heavy metals (Zn, Cd, Cr, Pb, and Hg) in the upper sediment levels were above the baseline levels in Lake Powell. The levels generally decreased with depth to baseline levels or lower. Microcosm studies using simulated air, Lake Powell water, and actual Lake Powell sediments revealed that the concentrations of heavy metals are exerting significant impacts on the biomass (average reduction of 35%) and oxygen production in the system (average reduction of 34%). Although the biota had a significant role in binding the heavy metals, most of the metals were found in the upper 2-cm layer of sediments with the possible exception of lead.

558. Merson, M. H., D. A. Golmann, K. M. Boyer, N. J. Peterson, C. Patton, L. G. Everett, H. Downs, A. Steckler, and W. H. Barker. 1974. Outbreak of Shigella-Sonne gastroenteritis on Colorado River raft trips. Am. J. Epidemiol. 100(3): 186-196.

RIVER-Colorado, WATER QUALITY

Documents the occurrence of gastroenteritis among recreationists rafting on the Colorado River.

559. Meyer, N. L., and D. W. Bromley. 1974. Interregional impacts of alternative water policies for irrigation in the western United States. Univ. Wisconsin, Water Resour. Center, Madison, WRC 74-03. 140 pp.

IRRIGATION, MANAGEMENT, POLICY, WATER RESOURCES

Compares the impacts of various water policies for irrigation between regions for western United States.

560. Meyers, C. J. 1966. Colorado River. Stanford Law Rev. 19: 1-75.

LAW, RIVER-Colorado, WATER RESOURCES

Discusses the laws that pertain to the Colorado River.

561. Meyers, J. S. 1962. Evaporation from the 17 western states. U. S. Geol. Surv. Prof. Pap. 272-D: 71-100.

WATER RESOURCES

Provides data on the evaporation from the western United States. Includes a section on evaporation rates by T. J. Nordenson.

562. Mihursky, J. A., and L. E. Cronin. 1973. Balancing needs of fisheries and energy production. Trans. N. Am. Wildl. and Nat. Resour. Conf. 38: 459-476.

ENERGY, FISH, MANAGEMENT, RESOURCES

Recommends a need for choosing between the alternatives of a sport fishery and energy development, to balance the needs of the American people.

563. Miller, D. D. 1975. Results of grayling transplants to the upper Green River. Wyo. Game Fish Dep., Cheyenne, Admin. Rep., Proj. 4074-14-6702. 6 pp.

FISH, MANAGEMENT, RIVER-Green

Summarizes the stocking records of grayling in 1939-73 by location, number, and size for the Green River. From about 9 to 33% of mature transplanted grayling were caught by fishermen. Stocking of eggs and fry was not judged to be successful. Grayling have not been observed to spawn successfully in the Green River.

564. Miller, G. L. 1959. An investigation of pollution in the Price River, Carbon County, Utah. M. S. Thesis, Univ. Utah, Salt Lake City. 70 pp.

INSECT, LIMNOLOGY, POLLUTION, RIVER-Price, SEDIMENT

Provides limnological data on the Price River and distribution of aquatic insects and some algae related to limnological conditions from December 1956 until December 1957. Large amounts of silt were believed to be the cause reducing plant and animal life in this river.

565. Miller, K. D. 1971. Spawning and early life history of largemouth bass Micropterus salmoides in Wahweap Bay, Lake Powell. M. S. Thesis, Utah State Univ., Logan. 39 pp.

AGE-GROWTH, FISH, FISHERY, FOOD HABITS, LIFE HISTORY, MANAGEMENT, RESERVOIR, RIVER-Colorado

Spawning time and habitat of largemouth bass, survival of embryos, growth, and food of fingerlings were studied in 1968 and 1969 in Wahweap Bay, Lake Powell. Spawning began in mid to late April, when mean daily water temperature at nesting depths was 14.4-15.0°C, and continued until mid June. Sandstone rubble was the most commonly used bottom type for nesting. Nearly all eggs required 4 days to hatch. Growth of fingerlings was similar, and most rapid before August 1, in both years. Fingerlings ate mostly crustaceans, insects, and fish.

566. Miller, K. D., and R. H. Kramer. 1971. Spawning and early life history of largemouth bass Micropterus salmoides in Lake Powell. Pages 73-83 in G. E. Hall, ed. Reservoir fisheries and limnology. Am. Fish. Soc. Spec. Publ. 8.

ABUNDANCE, AGE-GROWTH, FISH, FISHERY, FOOD HABITS, LIFE HISTORY, RESERVOIR, RIVER-Colorado

Spawning began in mid to late April, when mean water temperatures at nesting depths were 14.4-15.0°C. Bottom type used for spawning was most commonly rubble at the base of ledges around large sandstone boulders. Hatching required 4 days; survival to hatching was 80-90%. Fingerlings ate primarily crustaceans, insects, and fish.

567. Miller, R. R. 1946. Correlation between fish distribution and Pleistocene hydrography in eastern California and southwestern Nevada, with a map of the Pleistocene waters. J. Geol. 54: 43-53.

DISTRIBUTION, FISH, GEOLOGY, HYDROLOGY, RIVER-Colorado, WATERSHED

Physiographic description of the Pleistocene integrated river system, including part of the Colorado River with correlations between fish distribution and hydrography.

568. Miller, R. R. 1946. Gila cypha, a remarkable new species of cyprinid fish from the Colorado River in Grand Canyon, Arizona. J. Wash. Acad. Sci. 36(12): 409-415.

DESCRIPTION, FISH-rare, RIVER-Colorado

Gives detailed systematic description and comparison as well as notes on the habitat and associated fish. The new species is remarkable for its adaptation to torrential waters. A provisional comparison of the four subspecies of Gila robusta--intermedia, robusta, seminuda, and elegans--is also given. Only two species, robusta and cypha, were recognized from the Colorado River

569. Miller, R. R. 1946. The need for ichthyological surveys of the major rivers of western North America. Science 104(2710): 517-519.

DISTRIBUTION, FISH, SURVEY

Surveys of western rivers are needed because of changes caused by (1) the effects of dams and diversions, water power development, water storage, and irrigation practices; (2) pollution from mining operations; (3) destruction of vegetation by livestock, resulting in increased floods and erosion; and (4) introduction of exotic species.

570. Miller, R. R. 1952. Bait fishes of the lower Colorado River from Lake Mead, Nevada, to Yuma, Arizona, with a key for their identification. Calif. Fish Game 38(1): 7-42.

FISH, LIFE HISTORY, RIVER-Colorado

Presents a key and illustrations of native and introduced fishes used as bait along the lower Colorado River. Also presents various aspects of the distribution and habitat requirements of some of the fish and presents some possible problems caused by introduction of exotic species.

571. Miller, R. R. 1955. Fish remains from archaeological sites in the lower Colorado River basin, Arizona. Pap. Mich. Acad. Sci. Arts Lett. 40(1954): 125-136.

ARCHAEOLOGY, ECOLOGY, FISH, HISTORY, RIVER-Colorado

Remains of three species of fish from three sites in Arizona are described and illustrated. Certain bones dissected from two specimens preserved in alcohol are also illustrated. Man-made changes in the aquatic environment are discussed as causes in decimation or elimination of fish fauna. Current available data on size and habitat of the fishes now living are presented.

572. Miller, R. R. 1958. Origin and affinities of the freshwater fish fauna of western North America. Pages 187-222 in C. L. Hubbs, ed. Zoogeography. Am. Assoc. Adv. Sci. Publ. 51. Washington, D. C.

ARCHAEOLOGY, DISTRIBUTION, FISH, RIVER-Colorado

In the 21 families of freshwater fishes inhabiting North America, about 30% of the species are judged to be of North American origin, 55% Eurasian, and 15% South American. In western North America three Eurasian groups (Umbridae, Cyprinidae, and Catostomidae) account for 97% of the primary fauna. The fish fauna of the Colorado Basin is the richest and has the highest percentage of species endemism (87%) of the seven major western drainages.

573. Miller, R. R. 1961. Man and the changing fish fauna of the American Southwest. Pap. Mich. Acad. Sci. Arts Lett. 46: 365-404.

ABUNDANCE, DISTRIBUTION, FISH, FISH-rare, RIVER-Colorado

Documents the decline of native fish populations in the lower Colorado River basin and other nearby drainages. Discusses the factors resulting in the decline or extinction of many of the native fishes. Has direct application to the upper basin, since many of the large-river fishes discussed in the paper are also found in the upper basin.

best copy available

574. Miller, R. R. 1961. Speciation rates in some freshwater fishes of western North America. Pages 537-560 in W. F. Blair, ed. Vertebrate speciation. Univ. Texas Press, Austin.

ARCHAEOLOGY, DISTRIBUTION, FISH

Discussion of the evolutionary history of the fishes of the Colorado River and other river basins of the western United States.

575. Miller, R. R. 1963. Distribution, variation, and ecology of Lepidomeda vittata, a rare cyprinid fish endemic to eastern Arizona. Copeia 1963 (1): 1-5.

ABUNDANCE, DESCRIPTION, DISTRIBUTION, ECOLOGY, FISH, HABITAT, RIVER-Colorado

Provides information on the distribution, variation, and ecology of Lepidomeda vittata, a minnow native to the lower Colorado River System. Describes habitat changes and discusses reasons for decline of this fish. Includes notes on the former distribution of the Colorado Squawfish (Ptychocheilus lucius).

576. Miller, R. R. 1963. Is our native underwater life worth saving? Natl. Parks Mag. 37(188): 4-9.

FISH, FISH-rare, MANAGEMENT, RIVER-Green

Discusses the rotenone operation on the Green River before the closure of Flaming Gorge Dam and its impact on the native fish population.

577. Miller, R. R. 1964. Extinct, rare, and endangered American freshwater fishes. Proc. XVI Int. Congr. Zool. 8: 4-16.

ABUNDANCE, FISH-rare

Lists 38 species of fish that are low in abundance in the United States, including the humpback chub, Colorado squawfish, and humpback sucker.

578. Miller, R. R. 1964. Fishes of Dinosaur. Naturalist 15(2): 24-29.

DESCRIPTION, DISTRIBUTION, FISH, FISH-rare, RIVER-Green, Yampa

Short description of fish species occurring in Dinosaur National Monument, Colorado and Utah.

579. Miller, R. R. 1965. Quaternary freshwater fishes of North America. Pages 569-581 in H. E. Wright, Jr., and D. G. Frey., eds. The Quaternary of the United States. Princeton Univ. Press, New Jersey.

ARCHAEOLOGY, DISTRIBUTION, FISH

Current knowledge is summarized of the occurrence and distribution of North American fishes in the late Pliocene and Pleistocene. The Idaho Lake fauna (Plio-Pleistocene) of southern Idaho is discussed in some detail.

580. Miller, R. R. 1972. Threatened freshwater fishes of the United States. Trans. Am. Fish. Soc. 101(2): 239-252.

ABUNDANCE, DISTRIBUTION, FISH-rare

Threatened native freshwater fishes are listed for 49 states. Over 300 kinds are included in a formal classification, cross-indexed to states, followed by state lists and the status of each fish--whether rare, endangered, depleted, or undetermined. The concern for native fishes and the important factors responsible for threats to their existence are briefly outlined. Although the lists vary widely from those based on extensive recent state surveys to those on which current information is sparse, their publication is expected to enhance the chances for survival through protective legislation (already enacted by a number of states) and stronger concern for such natural resources.

581. Miller, R. R., and J. R. Alcorn. 1945. The introduced fishes of Nevada, with a history of their introduction. Trans. Am. Fish. Soc. 73: 173-193.

DISTRIBUTION, FISH

At least 39 species and subspecies of fishes were introduced into the waters of Nevada between 1873 and 1943, of which 24 have become established.

582. Miller, R. R., and C. L. Hubbs. 1960. The spiny-rayed cyprinid fishes (Plagopterini) of the Colorado River system. Misc. Publ. Univ. Mich. Mus. Zool. 115: 1-39.

DESCRIPTION, FISH, KEYS, RIVER-Colorado

The group formerly named Plagopterinae by Cope, and Medidae by some recent authors is here treated as a tribe within the Leuciscinae. The Plagopterini embrace the monotypic genera Meda and Plagopterus, and the polytypic genus Lepidomeda. The two previously recognized species of Lepidomeda are synonymized as L. vittata Cope (=L. jarrovii Cope), with the addition of L. mollispinis. The entire group is confined to the Colorado River system.

583. Miller, R. R., and C. H. Lowe. 1964. An annotated check list of the fishes of Arizona. Pages 133-151 in C. H. Lowe, ed. The vertebrates of Arizona. University of Arizona Press, Tucson.

DISTRIBUTION, FISH, FISH-rare

An account of the fishes of Arizona (most found in the Colorado River drainage) with short discussions of distribution and abundance of each fish in the state.

584. Milliken, J. G., D. C. Coddington, R. A. Zubrow, L. B. Creighton, and L. C. Lehman. 1972. Design of a method for estimating federal internal revenues generated by economic impact of reclamation projects. Prepared for U. S. Bureau of Reclamation by Ind. Econ. Div., Denver Research Institute, Univ. Denver, Denver, Colorado.

Part I. Text. 94 pp.
Part II. Technical appendix. 120 pp.

ECONOMICS, RECLAMATION

The development of a methodology for estimating the annual generation of federal revenues resulting from the reclamation program.

585. Milliken, J. G., and H. E. Meev. 1969. Economic and social impact of recreation at reclamation reservoirs: an exploratory study of selected Colorado reservoir areas. U. S. Bureau of Reclamation, Denver, Colo. 214 pp.

ECONOMICS, RECLAMATION, RECREATION, RESERVOIR, SOCIOLOGY

A social and economic impact study on selected reservoirs, including Shadow Mountain and Granby in eastern Grand County of the Colorado basin.

586. Minckley, W. L. 1965. Native fishes as natural resources. Pages 48-60 in J. L. Gardiner, ed. Native plants and animals as resources in arid lands of the southwestern United States, Southwest and Rocky Mountain Division. Comm. Desert Arid Zones Res., Am. Assoc. Advance. Sci., Contrib. 8.

FISH, HISTORY, MANAGEMENT

Gives a historical account of native fishes found throughout the Southwest, including the Colorado River basin. Proposes alternative uses of fish not ordinarily sought by sportsmen.

587. Minckley, W. L. 1971. Keys to native and introduced fishes of Arizona. J. Arizona Acad. Sci. 6: 183-188.

DESCRIPTION, FISH, KEYS

Artificial keys to the fishes of Arizona.

588. Minckley, W. L. 1973. Fishes of Arizona. Arizona Game and Fish Department, Phoenix. 293 pp.

DESCRIPTION, DISTRIBUTION, FISH, FISH-rare, FOOD HABITS, HISTORY, LIFE HISTORY, RIVER-Colorado

Gives aspects of the life history, distribution, habitat requirements, and historical accounts of fish species occurring in the state of Arizona, including many found in the upper basin of the Colorado River.

589. Minckley, W. L., and N. T. Alger. 1968. Fish remains from an archaeological site along the Verde River, Yavapai County, Arizona. Plateau 40: 91-97.

ARCHAEOLOGY, DESCRIPTION, DISTRIBUTION, ECOLOGY, FISH, FISH-rare, RIVER-Colorado

Five species of fishes, Pantosteus clarki, Catostomus insignis, Xyrauchen texanus, Gila r. robusta, and Ptychocheilus lucius were identified from an archaeological site of Pueblo Indians near Perkinsville, Yavapai County, Arizona. Discussed the ecological requirements of each fish. Three of the species still occur in the Verde River near Perkinsville and two are no longer present. Probable historic changes of the river are outlined.

590. Minckley, W. L., and J. E. Deacon. 1968. Southwestern fishes and the enigma of "endangered species." Science 159(3833): 1424-1432.

DISTRIBUTION, FISH, FISH-rare, HISTORY, RIVER-Colorado

Declines in the populations of native fishes in the American Southwest are largely due to habitat changes associated with man's modification of various aquatic environments. The diversion and impoundment of rivers, arroyo cutting, lowering of water tables through use of subsurface water for irrigation, eutrophication, and introduction of exotic species have been responsible for reductions in the native fish fauna.

591. Minckley, W. L., and G. C. Kobetich. 1974. Recovery plan for the razorback sucker, Xyrauchen texanus (Abbott). First draft. Lower Colorado Basin Recovery Team, U. S. Fish and Wildlife Service, Albuquerque, N.M. 27 pp. (Unpubl. manuscr.)

ABUNDANCE, DISTRIBUTION, MANAGEMENT, PLAN, RIVER-Colorado and tributaries

Gives a review of the literature available concerning the razorback (humpback) sucker and a description of the original and present distribution of this rare fish. The main emphasis of the plan is to outline a course of action that will prevent the extinction of this unique fish.

592. Mitchum, D. L. 1971. Effects of salinity of natural waters on various species of trout. Wyo. Game Fish Dep., Cheyenne. Game Fish Res., Proj. FW-3-R-18. 40 pp.

FISH, SALINITY, WATER QUALITY

Static bioassays were made for 6 weeks with combinations of calcium, magnesium, sodium, potassium, chloride, sulfate, and carbonate ions in ratios similar to those in natural Wyoming lakes and reservoirs. Trout mortalities normally occur at total dissolved solids above 5,000 ppm. Various combinations of these ions caused different mortalities in trout.

593. Moffett, J. W. 1942. A fishery survey of the Colorado River below Boulder Dam. Calif. Fish Game 28(2): 76-86.

ALTERATION, FISHERY, MANAGEMENT, RIVER-Colorado

Gives a description of the physical, chemical, and biological factors of the Colorado below Boulder Dam. Concentrates on the river's potential as a trout fishery, but lists fish (including native fish) collected during cursory sampling.

594. Moffett, J. W. 1943. A preliminary report on the fishery of Lake Mead. Trans. N. Am. Wildl. Conf. 8: 179-186.

FISHERY, RECREATION, RIVER-Colorado

Lake Mead was created by Boulder Dam in 1935-40. Bass fishing was excellent until 1940, but deteriorated in 1941. Maximum dimensions of the lake are 115 x 8 miles. Vegetation is almost absent, plankton is not abundant, and bottom fauna is sparse. Fishes include three native and six introduced species, among which the largemouth bass is the most important game fish.

595. Molles, M. 1980. The impacts of habitat alterations and introduced species on the native fishes of the upper Colorado River basin. Chapter 9 in W. O. Spofford, Jr., A. L. Parker, and A. V. Kneese, eds. Energy development and the water, fish, and wildlife in the Southwest: Problems of the upper Colorado River basin. Resources for the Future, Washington, D. C. In press.

ALTERATION, FISH-rare, HABITAT, RIVER-Colorado

Provides an overview of the impacts of habitat alteration and introduced fish species on the native fishes of the upper Colorado River basin. Also suggests that the marked partitioning in the ranges of the native fishes is due to a lack of abundance of ecological niches because of factors such as a dearth of vegetation, highly variable streamflows, and low productivity of the system.

596. Moore, C. V., and J. H. Snyder. 1974. Management of saline water. Univ. Calif., Dep. Agric. Econ., Water Resour. Cent. Rep. 29. 21 pp.

AGRICULTURE, ECONOMICS, IRRIGATION, LAW, MANAGEMENT, RESERVOIR, RIVER-Colorado, SALINITY, SURVEY, WATER QUALITY

Paper on salinity in Colorado River waters, with a discussion of economic, social, legal and other aspects of management.

597. Moore, C. V., J. H. Snyder, and P. Sun. 1974. Effects of Colorado River water quality and supply on irrigated agriculture. Water Resour. Res. 10(2): 137-144.

AGRICULTURE, IRRIGATION, RIVER-Colorado, WATER QUALITY, WATER QUANTITY

Reviews water quality and supply of the Colorado River as related to irrigated agriculture.

598. Moore, G. A. 1957. Fishes, Part II. Pages 31-210 in W. F. Blair, ed. Vertebrates of the United States. McGraw-Hill, New York.

ABUNDANCE, DESCRIPTION, DISTRIBUTION, FISH, KEYS

Listing of freshwater fishes in the United States with a key to their identification.

599. Moore, R. C. 1926. Significance of enclosed meanders in the physiographic history of the Colorado Plateau country. Geol. 34: 97-130.

GEOLOGY, RIVER-Colorado and tributaries

A discussion of the cause and significance of meanders in the Colorado River system.

600. Morgan, D. L., editor. 1964. The West of William H. Ashley. The Old West Publishing Company, Denver, Colo. 341 pp.

HISTORY, RIVER-Green

Description of the activities of William H. Ashley, who spent much of his time along the Green River during the early 1800's.

601. Mortensen, A. R., editor. 1960. The Colorado...River of the West. Utah Hist. Q. 28(3): 194-324.

HISTORY, MANAGEMENT, RECLAMATION, RIVER-Colorado, Green

Popular summary of papers on the Colorado River that describe the physical and ecological setting, the aboriginal peoples, development through reclamation, the Green River, and others. Provides a history of the Colorado River Storage Project that includes the much disputed Echo Park Dam, which was to be located in Dinosaur National Monument.

602. Morton, R. C. B., and G. G. Stamm. 1975. Critical water problems facing the eleven western states, westwide study. Report of the U. S. Bureau of Reclamation, Denver, Colo. 457 pp.

AGRICULTURE, ECOLOGY, ECONOMICS, ENERGY, MANAGEMENT, PLAN, RESOURCES, WATER QUANTITY

This western U. S. water plan (known as Westwide Study) was undertaken under authority of the Colorado River Basin Project Act (PL 90-537) in 1968. The goal of this report was to develop adequate information on which to base future significant decisions relative to water and related resources in 11 western states.

603. Moss, F. E. 1967. The water crisis. Frederick A. Praeger, Publ., New York. 305 pp.

AGRICULTURE, ALTERATION, ECONOMICS, LAW, POPULATION, RESOURCES, WATER QUANTITY

Discussion of the social, economic, and political conflicts that have occurred from the demand for a limited water resource in an area of expanding population. Gives recommendations toward a national water policy.

604. Mountain Empire Publishing, Inc. 1975-77 (Continuing). Shale country. Mountain Empire Publishing, Inc., Denver, Colo.

ECONOMICS, ENERGY, FISH, GEOLOGY, GROUNDWATER, HISTORY, LAW, MINERAL, POLICY, RIVER-Colorado and tributaries, WATER QUALITY, WATER QUANTITY

"Shale Country" is a magazine provided as a public service by the leaders in the oil-shale industry. Published monthly as a source of various types of information for those interested in oil shale and its development.

605. Mullan, J. W. 1973. Considerations in perpetuation of greenback cutthroat trout (Salmo clarki stomias). U. S. Fish and Wildlife Service, Vernal, Utah. Special Report. 26 pp.

FISH-rare, LIFE HISTORY, MANAGEMENT

Provides recommendations for the management of the rare greenback cutthroat trout that was formerly found in the headwaters of Rocky Mountain National Park in Colorado.

606. Mullan, J. W. 1974. Fishery management program, Uintah and Ouray Indian Reservation, Uintah and Duchesne Counties, Utah - 1973. U.S. Dep. Inter. Fish Wildl. Serv., Vernal, Utah. 20 pp.

FISH, MANAGEMENT, RIVER-Duchesne

Described the introduction of 5,400 1-inch smallmouth bass into 3 miles of the Uintah River downstream from Route 40 crossing on 23 June 1970 . Successful reproduction was observed in 1973. Several bass from this plant were caught by anglers below the confluence of the Duchesne and Green Rivers.

607. Mullan, J. W. 1974. Impoundments and their effects on aquatic resources. Proc. Annu. Conf. West. Assoc. State Game Fish Comm. 54: 367-380.

MANAGEMENT, RESERVOIR, WATER QUALITY

Reviews the effects of impoundments on aquatic resources, with primary emphasis on Colorado, Wyoming, and Utah.

608. Mullan, J. W. 1975. Condition (K) as indicative of non-suitability of Snake River cutthroat trout in the management of high gradient low diversity streams. Proc. Annu. Conf. West. Assoc. State Game Fish Comm. 55: 267-274.

AGE-GROWTH, DISTRIBUTION, FISH, FISHERY, MANAGEMENT, POPULATION

Using a comparison of condition (K) factors, the author has concluded that rainbow trout offer a better management option than Snake River cutthroat trout in the waters studied, which were high gradient streams with low lineal and cross sectional diversity. Evolutionary considerations as well as hatchery and environmental conditions are discussed.

609. Mullan, J. W. 1975. Fisheries habitat plan for the Uintah and Ouray Indian Reservation, as affected by the Uintah and Upalco Units of the Central Utah Project. U. S. Fish and Wildlife Service, Area Office Colorado-Utah, Salt Lake City, Utah. 132 pp.

FISHERY, HABITAT, PLAN, RECLAMATION

The purpose of this report was the analysis of available information on the fishery resources, to identify and quantify values associated with ecologically sound water development on Indian lands. The result is a synthesis of information, integrating biological technology with resource capability, allowing for effective fishery planning and management. The streams from this area drain into the Green River.

610. Mullan, J. W., V. J. Starostka, J. L. Stone, R. W. Wiley, and W. J. Wiltzius. 1976. Factors affecting Upper Colorado River reservoir tailwater trout fisheries. Pages 405-427 in J. F. Orsborn and C. H. Allman, eds. Proceedings, symposium and specialty conference, instream flow needs, Vol. II, Am. Fish. Soc., Washington, D. C.

FISH, FISHERY, HISTORY, INVERTEBRATE, RESERVOIR, RIVER-Colorado, SEDIMENT, TEMPERATURE, STREAMFLOW

Reviews various biological, chemical, and physical factors that affect the standing crop and harvest of trout from the tailwaters of reservoirs on the Upper Colorado River. Documents the historical changes that occurred in the trout fishery of the Glen Canyon tailwater between 1964 and 1972, and the Navajo tailwater between 1965 and 1973. Also provides a summary of the changes in benthic organisms in the Glen Canyon tailwater between 1963 and 1972.

611. Mullens, M. C. 1973. Bibliography of the geology of the Green River Formation, Colorado, Utah and Wyoming, to March 1, 1973. U. S. Geol. Surv. Water Supply Circ. 675. 20 pp.

BIBLIOGRAPHY, GEOLOGY, RIVER-Green

Includes 597 references on the areal geology, stratigraphy, paleontology, geochemistry, and mineralogy of the Green River Formation in Colorado, Utah, and Wyoming.

612. Mumey, N. 1955. John Williams Gunnison (1812-1853)--the last of the western explorers; a history of the survey through Colorado and Utah with a biography and details of his massacre. Artcraft Press, Denver, Colo. 189 pp.

HISTORY, RIVER-Gunnison, SURVEY

A historical account of Gunnison's exploration in Colorado and Utah.

613. Mundorff, J. C. 1968. Fluvial sediment in Utah, 1905-65; a data compilation. U. S. Geol. Surv. Inf. Bull. 20. 400 pp.

HYDROLOGY, SEDIMENT, WATER QUALITY

A compilation of all the sediment data collected in Utah during 60 years.

614. Mundorff, J. C. 1972. Reconnaissance of chemical quality of surface water and fluvial sediment in the Price River basin, Utah. Utah Dep. Nat. Resour., Salt Lake City, Tech. Publ. 39. 55 pp. + plates.

HYDROLOGY, RIVER-Price, STREAMFLOW, WATER QUALITY

The general chemical characterists of the main stem of the Price River changed markedly between the headwaters and the mouth. From the headwaters to about the junction with Spring Canyon Creek, the Price River generally had a dissolved solids content of less than 400 mg/l, mostly calcium bicarbonate. At Wellington, which is near the center of the basin, the dissolved solids content was between about 600 and 2,400 mg/l. At Woodside, which is about 22 miles upstream from the mouth, the weighted average dissolved solids concentration was generally between 2,000 and 4,000 mg/l.

615. Musser, G. G. 1959. Annotated checklist of aquatic insects of Glen Canyon. Pages 207-221 _in_ A. M. Woodbury, ed. Ecological studies of the flora and fauna in Glen Canyon. Univ. Utah, Anthropol. Pap. 40, Glen Canyon Ser. 7. 233 pp.

INVERTEBRATE, RIVER-Colorado

This report covers the aquatic insects collected on the 1958 ecological survey conducted in Glen Canyon by the University of Utah.

616. Musser, R. J. 1962. Dragonfly nymphs of Utah (Odonata: Anisoptera). Univ. Utah, Salt Lake City, Biol. Ser. 12(6). 71 pp.

DESCRIPTION, DISTRIBUTION, INVERTEBRATE, KEYS

Provides descriptions and keys for dragonfly nymphs found in Utah, with some information on distribution. Published version of an M. S. Thesis "Dragonfly nymphs of Utah," Univ. Utah., Provo, 1961.

617. Mustard, E. W. and C. D. Rector. 1979. Wetlands, irrigation and salinity control: Lower Gunnison River Basin, Colorado. Pages 310-317 _in_ G. A. Swanson, technical coordinator. The mitigation symposium: a national workshop in mitigating losses of fish and wildlife habitats. U. S. Forest Serv., Gen. Tech. Rep. RM-65.

ALTERATION, LAW, RIVER-Gunnison, WILDLIFE

A total of 8,773 ha of wetlands were inventoried on a 72,800-ha area as part of an environmental assessment for a salinity control project in the Lower Gunnison River Basin, Colorado. The implementation of measures to reduce salt loading in the Colorado River will result in wetland losses. The value and use of wetlands as habitat for wildlife are evaluated and suggestions for mitigation are suggested.

618. Myers, N. 1977. Garden of Eden to weed patch: the earth's vanishing genetic heritage. Nat. Resour. Defense Council Newsletter 6(1): 1-15.

ALTERATION, ECOLOGY, GENETICS, HABITAT, WILDLIFE

Discusses the worldwide accelerating rate of species extinction and resulting genetic impoverishment. Also provides reasons for the causes and implications for species extinction and a rationale for preservation.

619. Nace, R. L. 1960. Water management, agriculture, and groundwater supplies. U. S. Geol. Surv. Circ. 415. 12 pp.

AGRICULTURE, GROUNDWATER, HYDROLOGY, MANAGEMENT, WATER QUALITY, WATER QUANTITY

In view of current population and industrial expansion forecasts, water managers must recognize and prepare for future contingencies by making more efficient use of water, by developing improved quantitative evaluations of water supplies and quality, and by developing management practices which are based on scientific hydrology.

620. Nakamichi, H., and H. J. Morel-Seytoux. 1969. Suitability of the upper Colorado River Basin for precipitation management. Colorado State Univ., Fort Collins, Hydrol. Pap. 36. 62 pp.

MANAGEMENT, PRECIPITATION, RIVER-Colorado

Reviews the suitability for precipitation management by watersheds in the upper Colorado River Basin.

621. National Commission on Water Quality. 1976. Report on the Congress by the National Commission on Water Quality. Natl. Comm. Water Qual., Washington, D. C. 90 pp.

MANAGEMENT, WATER QUALITY

Published annually to summarize problems and progress in water quality in the United States.

622. National Referral Center for Science and Technology. 1965. A directory of information resources in the United States: physical sciences, biological sciences, and engineering. The Library of Congress, Natl. Referral Center Sci. Tech., Washington, D. C. 352 pp.

BIBLIOGRAPHY, ECOLOGY, MANAGEMENT

Provides sources of information available in the United States on physical and biological sciences and engineering.

623. National Research Council. 1968. Water and choice in the Colorado River Basin. Natl. Acad. Sci., Natl. Res. Council, Washington, D. C. 107 pp.

MANAGEMENT, POLICY, RIVER-Colorado, WATER QUANTITY

Provides information on the water supply of the basin and alternative decisions regarding its use.

624. Needham, J. G., and P. W. Claassen. 1925. A monograph of the Plecoptera or stoneflies of America north of Mexico. Vol. 2. Thomas Say Foundation, Lafayette, Indiana 397 pp.

DISTRIBUTION, INVERTEBRATE, KEYS, LIFE HISTORY

Key to the stoneflies found in America, including some found in the Colorado River Basin. Also includes short sections on the life history and distribution of stoneflies.

625. Neel, J. K. 1963. Impact of reservoirs. Pages 575-593, in D. G. Frey, ed. Limnology in North America. Univ. Wisconsin Press, Madison.

ECOLOGY, HYDROLOGY, LIMNOLOGY, RESERVOIR, RIVER-Colorado, SEDIMENT

Discusses the impact of reservoirs on the ecology of free-flowing streams. Provides specific information on the sedimentation and erosion of Lake Mead in the lower Colorado River. Similar phenomena may be expected to occur in the upper Colorado River basin.

626. Nehring, R. B. 1979. Stream fishery investigations: Job 1. Taylor River flow investigations. Colo. Dep. Nat. Resour., Div. Wildl., Montrose. Res. Proposal, Fed. Aid Proj. F-51-R. 23 pp.

FISH, RIVER-Gunnison tributary, STREAMFLOW

Describes a research proposal to continue Federal Aid Project F-51-R. The main objective is to determine the effects of a changed flow regime on the natural brown trout population in the Taylor River.

627. Nehring, R. B. 1979. Evaluation of instream flow methods and determination of water quantity needs for streams in the State of Colorado. Colo. Dep. Nat. Resour., Div. Wildl., Fort Collins. 144 pp.

RIVER-Gunnison, Yampa, STREAMFLOW, WATER QUANTITY

Evaluates various methods for determining the instream flow needs in Colorado streams. Streams selected for this evaluation include the Frying Pan River, tributary to the Gunnison River and the Williams Fork River, tributary to the Yampa River.

628. Nelson, Haley, Patterson, and Qurik; Coon, King, and Knowlton; and Valley Engineering. 1973. Utah State Colorado River complex, water quality management plan program design. Utah Div. Health Environ. Health Serv. Branch, Salt Lake City. 57 pp.

MANAGEMENT, POLLUTION, RIVER-Colorado, SALINITY, STREAMFLOW, WATER QUALITY

Presents a program to develop a comprehensive water quality management plan for the Colorado River basin in the State of Utah.

629. Nelson, Haley, Patterson, and Qurik; Coon, King, and Knowlton; and Valley Engineering. 1974. Waste load allocation for Colorado River complex water quality management plan. Div. Health, Environ. Health Serv. Branch, Salt Lake City. 229 pp.

MANAGEMENT, POLLUTION, RIVER-Colorado, SALINITY, STREAMFLOW, WATER QUALITY

Summary and evaluation of pollution problems in the Colorado River basin. Details existing wastewater treatment facilities and chemical and biological constituents of water, as well as treatment locations.

630. Nelson, Haley, Patterson, and Qurik; Coon, King, and Knowlton; and Valley Engineering. 1975. Utah State-Colorado River complex water quality, management plan. Utah, Div. Health, Environ. Health Serv. Branch, Salt Lake City. 266 pp. plus data appendix 204 pp.

MANAGEMENT, POLLUTION, SALINITY, STREAMFLOW, WATER QUALITY

Identified water quality problems in the Colorado River Basin and the State of Utah's program of remedial actions. Appendix contains data derived from six water quality sampling trips made during 1973-74 in the Utah portion of the basin.

631. Nelson, W., G. Horak, A. Hale, Z. Parkhurst, M. Lewis, D. Wagaman, E. Hoban, and J. Colt. 1976. Assessment of effects of altered stream flow characteristics on fish and wildlife. Part A: Rocky Mountains and Pacific Northwest - Rocky Mountain case studies. U. S. Fish Wildl. Serv., Off. Biol. Serv., Fort Collins. FWS/OBS-76-30.

DAM, LIMNOLOGY, RIVER-Colorado, STREAMFLOW

Case studies of altered streamflow regimes below dams, the impact on fisheries, and methodologies used to assess the flow requirements for 49 dams and diversions in the Rocky Mountain region. Includes case studies with an overview, description, recommendation, hydrology, biology, and analysis including some on the Colorado River and its tributaries in Arizona, Colorado, New Mexico, Utah, and Wyoming.

632. Nelson, W. C. 1955. Green Mountain reservoir studies. Colorado Dep. Game Fish, Denver. 214 pp.

AGE-GROWTH, FISH FOOD HABITS, INVERTEBRATE, LIMNOLOGY, MANAGEMENT, RESERVOIR, RIVER-Colorado

Study from April 1949 to December 1950, including limnology, bottom fauna, and fish. The data on fish include age and growth, food, and creel census. Species studied include brown and rainbow trout, as well as non-game mountain and white suckers.

633. Nelson, W. C. 1971. Comparative limnology of Colorado-Big Thompson Project reservoirs and lakes. Colo. Div. Game Fish Parks, Denver. Job Final Rep., Fed. Aid Proj. F-25-R-1-4. 108 pp.

ALTERATION, INVERTEBRATE, LIMNOLOGY, PLANKTON, RESERVOIR, River-Colorado, TEMPERATURE

Results of a limnological survey of reservoirs and lakes of the Colorado-Big Thompson Project based on annual samples in July-August 1962-65 and September 1966. The project includes 10 reservoirs and 1 natural lake interconnected by a system of canals, tunnels, siphons, and penstocks for diverting water from the western to the eastern slope of the Rocky Mountains.

634. Nelson, W. C., G. Horak, M. Lewis, and J. Colt. 1976. Assessment of altered stream flow characteristics on fish and wildlife. Part A: Rocky Mountain and Pacific Northwest-Executive summary. U. S. Fish Wildl. Serv., Off. Biol. Serv., Fort Collins, Colo. FWS/OBS-76-28. 14 pp.

DAM, LIMNOLOGY, RIVER-Green, STREAMFLOW

A concise summary of the findings, conclusions, and recommendations on changed streamflows below dams, the impact on fisheries, and methodologies used to assess flow requirements for 96 dams and diversions in the Rocky Mountain and Pacific Northwest regions.

635. Nelson, W. C., G. Horak, M. Lewis, and J. Colt. 1976. Assessment of effects of altered stream flow characteristics on fish and wildlife. Part A: Rocky Mountain and Pacific Northwest - Final report. U. S. Fish Wildl. Serv., Off. Biol. Serv., Fort Collins. FWS/OBS-76-29. 119 pp.

DAM, LIMNOLOGY, RIVER-Green, STREAMFLOW

Final report of the findings, conclusions, and recommendations on changed streamflows below dams, the impact on fisheries, and methodologies used to assess flow requirements for 96 dams and diversions in the Rocky Mountain and Pacific Northwest regions. Includes changed streamflows in Arizona, Colorado, Montana, Utah, and Wyoming.

636. Nelson, R. W., G. C. Horak, and J. E. Olson. 1978. Western reservoir and stream habitat improvements handbook. U. S. Fish Wildl. Serv., Office Biol. Serv., FWS/OBS-78 56. 250 pp.

ALTERATION, HABITAT, MANAGEMENT, RESERVOIR

This handbook is a guide for administrators, fish and game biologists, and engineers of construction agencies in selecting, recommending, and negotiating more effective measures for aquatic habitat improvement.

637. Neuhold, J. M., D. E. Herrick, and D. I. Patten, editors. 1975. Rocky Mountain environmental research--problems and research priorities in the Rocky Mountain region. Final Rep., National Sci. Found. (RANN), U. S. Forest Serv., Environ. Protect. Agency, and Ecol. Center, Utah State Univ., Logan.

Part I. Introduction and summary. 15 pp.
Part II. Task force reports
  A. Biological resources. 5 pp.
  B. Human needs and responses. 13 pp.
  C. Institutional arrangements. 19 pp.
  D. Mineral and energy resources. 42 pp.
  E. Recreation and tourism. 15 pp.
  F. Rural residential development. 45 pp.
  G. Timber and forage and uses. 16 pp.
  H. Water resources and uses. 51 pp.
Part III. Synthesis workshop report. 25 pp.
Part IV. Appendices. 6 pp.

ECOLOGY, ECONOMICS, ENERGY, GEOLOGY, MANAGEMENT, MINERAL, POLICY, POPULATION, RECREATION, RESOURCES, SOCIOLOGY, WATER QUALITY, WATER QUANTITY, WATERSHED

A comprehensive report that identifies research needed to maintain and enhance a high-quality environment in the Rocky Mountain Region for the long-term future. The conclusions and recommendations in this report resulted from the combined efforts of about 350 persons who represented society, academia, industry, and federal and state agencies.

638. New Mexico State Engineer. 1956. Report on La Plata Reservoir project for the La Plata Conservancy District, San Juan County, New Mexico. New Mexico State Engineer, Santa Fe. 6 pp.

AGRICULTURE, IRRIGATION, RESERVOIR, RIVER-San Juan

Provides various details on the La Plata Reservoir project.

639. New Mexico State Engineer. 1967. Water resources of New Mexico: occurrence, development, and use. New Mexico State Engineer and U. S. Geol. Surv., Water Res. Div., Santa Fe. 321 pp.

CLIMATE, GEOLOGY, HISTORY, HYDROLOGY, RIVER-San Juan, WATER QUALITY, WATER QUANTITY, WILDLIFE

Provides data on water supply, water regulations, water uses, and interstate water compacts, as well as geology, hydrology, history of use covering settlement, development, and use by basin. San Juan River Basin included on pages 185-210.

640. New Mexico Water Quality Board. 1970. Water quality standards summary. New Mexico Water Quality Board and U. S. Fed. Water Pollut. Contr. Admin., Washington, D. C. 29 pp.

MANAGEMENT, POLICY, WATER QUALITY

Summarizes standards for water quality in New Mexico.

641. Newlin, J. T., and R. C. Ward. 1974. An analysis of non-point source pollution in the Rocky Mountain-Prairie Region. Preliminary Draft, Part I. Civil Eng. Study Proj. 31-4040-2050. U. S. Environ. Prot. Agency. Denver, Colo. 430 pp.

DESCRIPTION, POLLUTION, SURVEY

Provides a description of the identified non-point sources of pollution within the six-state area of Colorado, Utah, Wyoming, Montana, North Dakota, and South Dakota which makes up region VIII, under the jurisdiction of the Denver office of EPA. Areas of concern in the investigation include irrigation return flows, range and watershed managment, logging and forestry (erosion, slashburning, etc.), rural domestic wastes (septic tanks), livestock and waste disposal, pesticides and fertilizers, land disposal (sludge and municipal sewage), and surface and groundwater problems.

642. Nichols, S. R., G. V. Skogerboe, and R. C. Ward. 1972. Water quality management decisions in Colorado. Colorado State Univ., Fort Collins Environ. Resour. Cent., AER 71-72SRN-GVS-RCW8.

MANAGEMENT, POLICY, WATER QUALITY

Discusses criteria for establishing policy for water quality in Colorado.

643. Nielsen, L. T., and D. M. Rees. 1961. An identification guide for the mosquitoes of Utah. Univ. Utah. Biol. Series 12(3): 1-72.

DESCRIPTION, INSECT

Guide to identification of mosquitoes found in Utah.

644. Nobe, K. C., and A. H. Gilbert. 1970. A survey of sportsmen expenditures for hunting and fishing in Colorado, 1968. Colorado Div. Game, Fish, Parks, Denver. Tech. Publ. 24. 83 pp.

ECONOMICS, FISH, RESOURCE, SOCIOLOGY, SURVEY, WILDLIFE

A sample of 11,678 Colorado hunters and fishermen were selected randomly from 290,000 licensees, including both residents and non-residents of the state. The data were collected from two separate studies: a socio-economic survey in 1966-67 and a gross expenditure survey in 1968. Data with a sound economic foundation were needed by agencies responsible for the allocation of natural resources, particularly in their consideration of alternative uses of these resources.

645. Nolting, D. H. 1956. The effects of uranium mill waste disposal on the fish populations and aquatic productivity of the lower San Miguel and Dolores Rivers. Colorado Dep. Game Fish, Denver. 15 pp.

DISTRIBUTION, FISH, MINERAL, RIVER-Dolores

Survey of the San Miguel and Dolores Rivers to determine the effects of uranium waste disposal located at Naturita and Uravan. Includes information on the presence of fish in these rivers. One Colorado squawfish was collected in the Dolores River on 13 July 1955.

646. Nordin, C. F. 1971. Erosion and sedimentation. Trans. Am. Geophys. Union 52(6): 292-295.

EROSION, SEDIMENT, STREAMFLOW

Reviews channel morphology and streamflow relation to erosion and sedimentation. Also provides information on stochastic processes and model studies.

647. Norington, A. 1925. Phycological study of some of the mountain lakes and streams of the Wasatch and Uinta ranges in Utah. Ph. D. Thesis. Univ. Chicago, Chicago. 31 pp.

SURVEY, VEGETATION, WATER RESOURCES

Survey of the phycology of selected mountain lakes and streams of the Uinta Mountains. The streams on the south slopes of these mountains drain into the Green River.

648. Oak Creek Power Company. 1976. Oak Creek water and power project. Oak Creek Power Company, Denver, Colo. Docket P-2773. 11 pp. + exhibits A through I, various pagination.

DAM, POWER, RESERVOIR, RIVER-Yampa, WATER RESOURCES

Application for a preliminary permit to the Federal Power Commission for a feasibility study for constructing a potential hydroelectric project in the vicinity of Oak Creek, Colorado. The proposal calls for two reservoirs to be constructed, including the Blacktail Reservoir on the Yampa River. The gross storage capacity of the reservoirs would be 151,509 acre-feet.

649. Oak Ridge National Laboratory. 1970. Special report on status of desalting: comprehensive framework study. U. S. Dep. Inter., Office of Saline Water, Washington, D. C., and Oak Ridge National Lab., Oak Ridge, Tenn. 111 pp.

SALINITY, SURVEY, WATER QUALITY

A state-of-the-art survey to give water resource engineers a background in desalting technology and costs. The salinity problem is particularly applicable to the lower Colorado River but it begins in the upper basin.

650. Oblad, B. R. 1969. A study of the stoneflies (Plectopera) of the Yampa River drainage system, Moffat and Routt Counties, Colorado. M. S. Thesis, Univ. Montana, Missoula. 146 pp.

DISTRIBUTION, INSECT, LIFE HISTORY, RIVER-Yampa

Covers the taxonomy and distribution of stoneflies in the Yampa River. Provides a key to the families of stoneflies and a list of species. Discusses adult behavior, habitat of the nymphs, and altitudinal distribution.

651. Ohmart, R. D., W. O. Deason, and S. J. Freedland. 1975. Dynamics of march land formation and succession along the lower Colorado River and their importance and management problems as related to wildlife in the arid Southwest. Trans. N. Am. Wildl. Nat. Resour. Conf. 40: 240-251.

ECOLOGY, MANAGEMENT, RIVER-Colorado, WATER QUANTITY, WILDLIFE

Report on the larger and more important historical and present-day backwaters and their probable and known value to selected wildlife species on the lower Colorado River. Backwater areas such as these are known to be important to wildlife along the upper reaches of the river as well; these areas are important to threatened and endangered fish species endemic to the river.

652. Olive, J. R. 1953. A bibliography of the limnology and fishery biology of Colorado. Colorado Game Fish Dep., Fish. Manage. Div., Denver. 37 pp.

BIBLIOGRAPHY, FISH, INSECT, INVERTEBRATE, PLANKTON

Bibliography on many subjects: Protozoa, Mollusca, Entomostraca, Insecta, Collembola, Ephemeroptera, Odonata, Plecoptera, Hemiptera, Trichoptera, Coleoptera, Diptera, fishes (ichthyology), Amphibia, fish management, general fishery biology, and general limnological studies in the state of Colorado.

653. Olson, J. E. and G. C. Horak. 1979. Successful and potentially successful measures to protect and improve fish and wildlife habitats. Pages 429-433 in G. A. Swanson, technical coordinator. The mitigation symposium: a national workshop in mitigating losses of fish and wildlife habitats. U. S. Forest Serv., Gen. Tech. Rep. RM-65.

ALTERATION, FISH, HABITAT, RIVER-Green, WILDLIFE

Discusses measures that have or could protect and improve fish and wildlife habitats such as reservoir water-level management, fish propagation and control, and wildlife protection at canals. Includes information on Flaming Gorge Dam in Wyoming and Utah.

654. Olson, H. F. 1959. Investigations ot specific problems of the Utah fishery: ecological aspects of the Utah chub in Scofield Reservoir with specific reference to reproduction. Utah State Dep. Fish Game, Salt Lake City, Fed. Aid Proj. F-004-R-05/Job R. 39 pp.

ECOLOGY, FISH, LIFE HISTORY, MANAGEMENT, RIVER-Green and tributaries

Provides information on the ecology of the Utah chub in Scofield Reservoir, which drains into the Green River. Provides specific information on the reproduction of this undesirable species.

655. Olson, H. F. 1959. The biology of the Utah chub, Gila atraria (Girard), of Scofield Reservoir, Utah. M. S. Thesis, Utah State Univ., Logan. 34 pp.

AGE-GROWTH, DISTRIBUTION, FISH, LIFE HISTORY

Summarizes the distribution, age and growth, food, and spawning of the Utah Chub in Scofield Reservoir, which drains into the Green River.

656. Olson, H. F. 1962. A pre-impoundment study of Navajo Reservoir, New Mexico. Fed. Aid Proj. F-22-R-3, Job No. B-1, New Mexico Dep. Game and Fish, Albuquerque. 29 pp.

ABUNDANCE, FOOD HABITS, FISH, INVERTEBRATES, PRECIPITATION, RIVER-San Juan, SEDIMENT, WATER QUALITY

Survey of the biological, chemical, and physical factors of the San Juan River prior to the impoundment of Navajo Dam between 1 April 1961 and 31 March 1962. Summarizes the fish species composition of the San Juan River in New Mexico. Colorado squawfish composed 1.4% by number and 12.8% by weight in this survey.

657. Olson, H. F. 1962. Statewide rough fish control--rehabilitation of the San Juan River. Fed. Aid Proj. F-19-D-4, Job Completion Report. N.M. Dep. Game Fish, Albuquerque. 6 pp.

ALTERATION, FISH, FISHERY, MANAGEMENT, RESERVOIR, RIVER-San Juan

The San Juan River and tributaries upstream from the Navajo Dam were treated with rotenone to eliminate trash fish species within the proposed impoundment area. Fourteen species were eliminated. The most abundant species found were the flannelmouth sucker and the bonytail chub.

658. Olson, H. F., and W. J. McNall. Fishery investigations - Navajo Unit; Fishery surveys of Navajo Reservoir and tailwaters. Job Nos. A-2(a) and A-2(b), Section 8, Colorado River Storage Proj., New Mexico Dep. Game and Fish, Albuquerque. 89 pp.

ABUNDANCE, AGE-GROWTH, FISH, PLANKTON, RESERVOIR, RIVER-San Juan, WATER QUALITY

Summarizes data on capacity and releases from Navajo Reservoir between June 1962 and December 1964. Provides fish species composition by numbers and weight for 1963 and 1964. Summarizes the volumes of phytoplankton and zooplankton for Navajo Lake between August 1963 and June 1964. Also provides information on water quality, particularly on water temperature and dissolved oxygen.

659. Olson, R. L. 1962. The Colorado River compact. Ph.D. Thesis, Harvard Univ. Cambridge, Mass. 527 pp.

LAW, RIVER-Colorado

Reviews the water rights associated with the compact.

660. Orsborn, J. F., and C. H. Allman, editors. 1976. Proceedings of the symposium and specialty conference on instream flow needs. Am. Fish. Soc., Washington, D. C. Vol. I, 551 pp.; Vol. II, 657 pp.

ECONOMICS, FISH, HABITAT, INVERTEBRATE, IRRIGATION, LAW, MANAGEMENT, MODEL, POWER, RECREATION, RESERVOIR, SOCIOLOGY, STREAMFLOW, WATER QUANTITY, WILDLIFE

Comprehensive treatment of instream flow needs that emphasize the interdisciplinary aspects of current problems, particularly problems in communication and the awareness of legal, social, and technical aspects of preserving instream values for various uses including fish, recreation and wildlife. Many of the concepts can be applied to the Upper Colorado River System and some papers deal directly with the Colorado River and its tributaries.

661. Pacific Southwest Inter-Agency Committee. 1964. Water quality related responsibilities. Task Force Rep., Tech. Subcomm. on Water Qual., Pacific Southwest Inter-Agency Comm. 38 pp.

POLICY, RIVER-Colorado, WATER QUALITY

Summarizes statements from member states and federal agencies on their respective responsibilities for water quality of the Colorado River.

662. Pacific Southwest Inter-Agency Committee. 1971. The Pacific Southwest analytical summary report on water and land resources. Pacific Southwest Inter-Agency Committee for U. S. Water Resources Council, Washington, D. C. 185 pp.

DESCRIPTION, PLAN, WATER QUANTITY

Summarizes the framework studies of the four major water resource regions of the Pacific Southwest--California, Great Basin, Lower Colorado, and Upper Colorado--produced by cooperating federal and state agencies between 1966 and 1971. Federal and state comments on this summary report are under a separate cover as exhibits A-N.

663. Pahren, H. R., and W. W. Towne. 1960. Waste disposal aspects of potential pulp mills in western Colorado. U. S. Dep. Health, Educ., Welfare, Public Health Serv., Cincinnati, Ohio. 16 pp.

POLLUTION, RIVER-Colorado, Gunnison, White, SURVEY

Survey of pulp mill waste disposal in the Colorado, Gunnison, and White Rivers.

664. Paist, D. A., and W. B. Pings. 1970. Vanadium-1970. Colorado School of Mines, Golden, Mineral Ind. Bull. 13(4): 1-24.

DISTRIBUTION, HISTORY, MINERAL

Describes the history of vanadium, its physical properties, and distribution of ore deposits --such as those on the sandstones of the Colorado Plateau, which are the most productive source of this element.

665. Palmer, W. C., and L. M. Denny. 1971. Drought bibliography. U. S. Natl. Ocean. Atmos. Admin., Tech. Memo. EDS-20. 247 pp.

BIBLIOGRAPHY, CLIMATE

Bibliography on various effects of drought.

666. Parish, R. B. 1975. Status of rare native fish in New Mexico. N. M. Dep. Game Fish, Santa Fe, Fed. Aid Proj. F-22-R-16, Job No. I-3. 41 pp.

DISTRIBUTION, FISH, RIVER-San Juan, SURVEY

Report of a survey to locate fish that were considered to be rare or endangered in New Mexico. The Colorado squawfish was verified in the San Juan River in 1965 near Castlerock, N. M., and is believed to still be in this river.

667. Parker, A. S. 1980. Potential impacts of energy development on land use and recreation in the upper Colorado River basin. Chapter 5 in W. O. Spofford Jr., A. L. Parker, and A. V. Kneese, editors. Energy development and the water, fish, and wildlife in the Southwest: Problems of the upper Colorado River basin. Resources for the Future, Washington, D. C. In press.

ENERGY, PLAN, RECREATION, RIVER-Colorado

Gives an assessment of the impacts of energy development on land use and recreation in the upper basin as well as the effects of population increases on 20 U. S. Forest Service recreation sites in southwestern Colorado.

668. Patterson, J. L., and W. P. Somers. 1966. Magnitude and frequency of floods in the United States, Part 9. Colorado River Basin. U. S. Geol. Surv., Water-Supply Pap. 1683. 475 pp.

CLIMATE, FOOD HABITS, HYDROLOGY, RIVER-Colorado and tributaries, STREAMFLOW

Outlines methods for determining the magnitude and frequency of expected floods at various recurrence intervals at most points in the Colorado River basin. Some larger streams are treated separately.

669. Patton, P. R., and P. F. Folliott. 1975. Selected bibliography of wildlife and habitats for the Southwest. U. S. For. Serv. Gen. Tech. Rep. RM-16. 40 pp.

BIBLIOGRAPHY, HABITAT, WILDLIFE

A selected bibliography on wildlife habitat management for wildlife biologists in the Southwest. Contains 390 selected references on research and management of important wildlife species and habitats in Arizona and New Mexico, covering a period from 1913 to early 1975. A subject index is keyed to an alphabetical list of authors.

670. Payne, J. M. 1979. Interrelationships between benthic macroinvertebrates and habitat in a mountain stream. M. S. Thesis, Utah State Univ., Logan. 79 pp.

ABUNDANCE, ECOLOGY, INSECT, RIVER-Green and tributaries

The seasonal abundance and species composition of benthic macroinvertebrates in various habitats (riffles and pools) were summarized for the upper Strawberry River (tributary to the Green River) in Utah. Fifty-nine taxa of invertebrates were collected during sampling every 2 months from November 1975 through August 1976. Results of analysis of variance and covariance demonstrated that time was the most important factor that influenced the distribution of most taxa (85%), followed by time x habitat interaction (20%), velocity (18%), habitat (11%), and depth (8%). Results of nonparametric tests suggested that the majority of taxa migrated into "pools" during periods of snow, ice, and low flows--an indication that "pools" may provide refuge to macroinvertebrates during periods of stream dewatering and diversion.

671. Pearson, W. D. 1967. Distribution of macroinvertebrates in the Green River below Flaming Gorge Dam, 1963-1965. M. S. Thesis, Utah State Univ., Logan. 105 pp.

INSECT, INVERTEBRATE, RIVER-Green

Describes the changes in invertebrate distribution caused by a fish control operation in September 1962 and the closure of Flaming Gorge Dam in November 1962. The species composition of the fauna above Carr Ranch (44.4 miles below the dam) was much simpler during 1964-65 than that reported before impoundment. Below Carr Ranch, the species composition of the invertebrate fauna changed little. Drift rates of Baetis nymphs and Simuliidae larvae were highest near the dam. Illumination, population density of other organisms, and water temperature had significant effects on drift net catches of Baetis and Simuliidae. Turbidity and water level fluctuations had important effects under certain circumstances, whereas month, dissolved oxygen, and depth of water had little effect on drift net catches.

672. Pearson, W. D., and D. R. Franklin. 1968. Some factors affecting drift rates of Baetis and Simuliidae in a large river. Ecology 49(1): 75-81.

INSECT, INVERTEBRATE, RIVER-Green

Effects of eight factors on the drift rates of Baetis nymphs and Simuliidae larvae were tested with multiple regression analyses. Illumination, population density of all other organisms, and temperature had significant influences on drift rates of both groups of organisms. Turbidity and water-level fluctuations were related to changes in drift rates indirectly through influence on light penetration and population density, respectively. Dissolved-oxygen concentration, calendar date, and depth of water at the sample site did not clearly affect drift rates of organisms of either taxon.

673. Pearson, W. D., R. H. Kramer, and D. R. Franklin. 1968. Macroinvertebrates in the Green River below Flaming Gorge Dam, 1964-65 and 1967. Proc. Utah Acad. Sci. Arts Lett. 45: 148-167.

ABUNDANCE, DISTRIBUTION, INVERTEBRATE, RIVER-Green

Describes the changes in the river environment after the closure of Flaming Gorge Dam and the changes in the distribution and abundance of invertebrates.

674. Pennak, R. W. 1947. Keys to the aquatic insects of Colorado. Univ. Colo. Stud. Ser. D 2(3): 353-383.

INSECT, KEYS

Keys to orders, families, and genera of aquatic insects found in Colorado.

675. Pennak, R. W. 1950. A limnological reconnaissance of Grand Mesa, Colorado. Univ. Colo. Biol. Serv. 1: 15-23.

LIMNOLOGY, RIVER-Colorado, Gunnison, SURVEY

Limnological inventory of the lakes (August 1947) in the Grand Mesa region, with the Colorado River drainage to the north and Gunnison River drainage to the south.

676. Pennak, R. W., and E. D. Van Gerpen. 1947. Bottom fauna production and physical nature of the substrate in a Colorado trout stream. Ecology 28(1): 42-48.

ECOLOGY, INSECT, STREAMFLOW

Relates the substrate to the production of stream-dwelling insects in Colorado.

677. Perkins, P. C. 1974. Scientific information in the decision to dam Glen Canyon. Univ. California, Inst. Geophys., Lake Powell Res. Proj., Bull. 9. 17 pp.

DAM, MANAGEMENT, RIVER-Colorado

Discusses the impact of scientific information on the decision-making process during the building of Glen Canyon Dam.

678. Peterson, S. R. 1969. Waterfowl ecology and utilization of Uinta Mountain water areas. M. S. Thesis, Utah State Univ., Logan. 67 pp.

ECOLOGY, FOOD HABITS, HABITAT, MIGRATION, VEGETATION, WATER RESOURCE, WILDLIFE

Waterfowl ecology of the Uinta mountain water areas, with emphasis on factors controlling distribution of breeding and migratory birds.

679. Pfeffer, F. M. 1974. Pollutional problems and research needs for the oil shale industry. Robert S. Kerr Environmental Research Lab., Ada, Okla., Rep. to U. S. Environ. Prot. Agency, Office Water Res. Technol., Environ. Prot. Technol. Ser. Rep. EPA-660/2-74-067, and Natl. Tech. Inf. Serv., Springfield, Va. PB-236 608/6SL. 44 pp.

POLLUTION, RIVER-Colorado, WATER QUALITY

The oil shale resources and surface stream drainage within the Green River Formation of Colorado, Utah, and Wyoming are presented briefly. Oil shale retorting in place is summarized. The subject of major concern, stabilization of spent shale residue, is covered in detail. Other subjects of environmental concern discussed are retort waste water, process water from shale-oil upgrading, dewatering operations, mineral recovery, and contamination of groundwater by radioactivity.

680. Phenicie, C. K., and J. R. Lyons. 1973. Tactical planning in fish and wildlife management and research. U. S. Fish Wildl. Serv., Resour. Publ. 123. 19 pp.

FISH, MANAGEMENT, PLAN, WILDLIFE

An outline to identify and state tactical objectives in planning and establishing management and research priorities. This procedure has the goal of precise problem solving.

681. Phoenix, D. A. 1961. Proposed classification of groundwater provinces, hydrologic units, and chemical types of groundwater in the upper Colorado River basin. U. S. Geol. Surv. Prof. Pap. 424-C: C125-C127.

GEOLOGY, GROUNDWATER, HYDROLOGY, MANAGEMENT, MINERAL, RESOURCE, WATER QUANTITY

Reports the results of a U. S. Geological Survey hydrologic study designed to gather and analyze information about water resources of the upper basin, to provide a basis for intelligent planning of future water developments in the basin. Divides the upper basin into six groundwater provinces, groups rocks in seven hydrologic units defined in terms of their potential groundwater yield, and classifies spring and well groundwater by their dissolved solid content.

682. Pings, W. B. 1967. Water pollution in Colorado--Part 1. Colorado School of Mines, Golden, Mineral Ind. Bull. 10(6): 1-13.

HISTORY, LAW, POLLUTION, RIVER-Colorado, WATER QUALITY

Reviews the history of water in the West and the nation, discusses the legislation on water pollution, and describes the river basins of Colorado.

683. Pings, W. B. 1968. Water pollution in Colorado--Part II. Colorado School of Mines, Golden, Mineral Ind. Bull. 11(1): 1-20.

LAW, POLLUTION, RIVER-Colorado, WATER QUALITY

Reviews the water quality standards for Colorado, discusses water pollution in the state, describes competition for water uses, and identifies research needs in water pollution.

684. Pister, E. P. 1976. A rationale for the management of nongame fish and wildlife. Fisheries (Bull. Am. Fish. Soc.) 1(1): 11-14.

FISH, MANAGEMENT, POLICY, WILDLIFE

Offers rationale for managers to consider in the management of nongame species.

685. Platts, W. S. 1958. The natural reproduction of the cutthroat trout, Salmo clarki Richardson, in Strawberry Reservoir, Utah. M. S. Thesis, Utah State Univ., Logan. 67 pp.

FISH, GRAZING, MANAGEMENT, RESERVOIR

Downstream traps were placed in tributaries entering Strawberry Reservoir to evaluate the success of natural reproduction and artificial propagation. The effects of beaver and cattle on cutthroat trout are discussed. Homing, mortality, and movements of marked spawners were studied. Strawberry Reservoir ultimately drains into the Green River.

686. Platts, W. S. 1960. Investigations of specific problems of the Utah fishery: investigations of Strawberry Reservoir tributaries. Utah Dep. Fish Game, Salt Lake City, Fed. Aid Proj. F-004-R-04/Job P. 67 pp.

ECOLOGY, FISH, LIFE HISTORY, MANAGEMENT, RIVER-Green tributary

Data on the life history and management of the fish species in Strawberry Reservoir, which drains into the Green River.

687. Platts, W. S., and W. R. Meehan. 1980. Livestock grazing and fish environments: situation and needs. U. S. Forest Serv., Gen. Tech. Rep. PSW. In press.

FISH, GRAZING, MANAGEMENT

Concisely summarizes the research needs to determine the effects of livestock grazing in western United States on fish habitat. The contents of this paper are quite applicable to the Upper Colorado River Basin.

688. Polchow, D., M. J. Lindberg, and L. C. Gabrish. 1974. Bibliography of water management. Dep. of Agricultural and Irrigation Engineering, Utah State Univ., Logan. 359 pp.

AGRICULTURE, BIBLIOGRAPHY, WATER RESOURCE

A compilation of all relevant book titles (9,132) located at Utah State University that concern on-farm water.

689. Ponce, S. L. II. 1975. Examination of a non-point source loading function for the Mancos Shale Wildlands of the Price River Basin, Utah. Ph. D. Thesis, Utah State Univ., Logan. 176 pp.

EROSION, PRECIPITATION, RIVER-Price, SALINITY, STREAMFLOW, WATER QUALITY

Summarizes the role of overland flow, resulting from storms of short duration but of high intensity, on increases in salinity from diffuse sources in the Price River Basin.

690. Potter, L. D. 1980. The ecology of the Colorado River reservoir shorelines. Chapter 11, in W. O. Spofford Jr., A. L. Parker, and A. V. Kneese, editors. Energy development and the water, fish, and wildlife in the Southwest: Problems of the upper Colorado River basin. Resources for the Future, Washington, D. C. In press.

ECOLOGY, RESERVOIR, RIVER-Colorado, VEGETATION

Analyzes the effects of fluctuating water levels in reservoirs on the aquatic-terrestrial interface using examples from extensive field surveys of Lake Powell.

691. Potter, L. D., and N. B. Pattison. 1976. Shoreline ecology of Lake Powell. Univ. Calif. Inst. Geophys., Lake Powell Res. Proj. Bull. No. 29. 238 pp.

ECOLOGY, RESERVOIR, RIVER-Colorado, VEGETATION

Relates changes in ecology and vegetation from fluctuating water levels in Lake Powell.

692. Powell, G. C. 1958. Evaluation of the effects of a power dam water release pattern upon the downstream fishery. M. S. Thesis, Colorado State Univ., Fort Collins. 149 pp.

ECOLOGY, FISH, FOOD HABITS, INVERTEBRATE, RIVER-Colorado, STREAMFLOW

Study of the power dam water releases on the fish and invertebrates below Green Mountain Reservoir, located on the Blue River--a stream that enters the Colorado River near Kremmling, Colorado.

693. Powell, J. W. 1957. The exploration of the Colorado River of the West and its tributaries. Univ. Chicago Press, Chicago. 137 pp.

ARCHAEOLOGY, HISTORY, RIVER-Colorado, Green

Account of John Wesley Powell's exploration of the Green and Colorado Rivers. Abridged from the 1st edition of 1875.

694. Powell, J. W. 1961. The exploration of the Colorado River and its canyons. Dover Publishing Co., New York. 400 pp.

ARCHAEOLOGY, HISTORY, RIVER-Colorado, Green

John Wesley Powell's account of his float trip through the Colorado Basin from Green River, Wyoming, through the Grand Canyon of Arizona.

695. Powell, J. W. 1964. Canyons of the Colorado. Argosy-Antiquarian, New York. 400 pp.

ARCHAEOLOGY, GEOLOGY, HISTORY

A revision of John Wesley Powell's diary of his trip from Green River, Wyoming, to the Grand Canyon of the Colorado; first published in 1895.

696. Powell, J. W. 1969. Down the Colorado: diary of the first trip through Grand Canyon, 1869. E. P. Dutton, New York. 168 pp.

ARCHAEOLOGY, HISTORY, RIVER-Colorado, Green

Portions of Major John Wesley Powell's diary, illustrated with modern photographs by Eliot Porter.

697. Pratt, H. P. 1937. Population studies of the trout of the Gunnison River. Univ. Colorado Stud. 24: 107-116.

DISTRIBUTION, FISH, RIVER-Gunnison

Distribution of trout in the Gunnison River, 1927-37.

698. Pratt, H. P. 1938. Ecology of the trout of the Gunnison River. Ph. D. Thesis, Univ. Colorado, Boulder. 197 pp.

DISTRIBUTION, ECOLOGY, FISH, FOOD HABITS, HISTORY, RIVER-Gunnison

Field studies made on the Gunnison River between 1927 and 1937 emphasized the factors affecting occurrence and distribution of trout. Stomach contents of over 10,000 trout were analyzed--those of about 500 in detail. Also provides data on plants and invertebrates. Relates fish distribution to habitat. Reviews the history of trout introductions and fishing on the Gunnison River.

699. Pratt, H. S. 1923. A manual of land and freshwater vertebrate animals of the United States (exclusive of birds). P. Blakiston's Sons and Co., Philadelphia. 437 pp.

ABUNDANCE, DESCRIPTION, DISTRIBUTION, FISH, WILDLIFE

Anatomical descriptions, distribution, and abundance of vertebrates found in the United States including fish found in the Colorado River.

700. Prewitt, C. G., and C. A. Carlson. 1975. Results of fisheries study, Yampa and White Rivers, June 10-September 17, 1975. Dep. Fish. Wildl. Biol., Colorado State Univ., Fort Collins. 25 pp.

DISTRIBUTION, FISH, RIVER-White, Yampa, SURVEY

Progress report of a fish study in the Yampa and White Rivers near areas to be affected by energy development.

701. Prewitt, C. G., D. E. Snyder, E. J. Wick, and C. A. Carlson. 1976. Baseline survey of aquatic macroinvertebrates and fishes of the Yampa and White Rivers, Colorado. Annu. Rep. U.S. Dep. Inter., Bur. Land Manage. Proj. 31-1474-1744. Dep. Fish. Wildl. Biol., Colorado State Univ., Fort Collins. 60 pp.

ABUNDANCE, AGE-GROWTH, DISTRIBUTION, FISH, FOOD HABITS, GENETICS, HABITAT, INVERTEBRATE, STREAMFLOW, SURVEY, WATER QUALITY

Survey of the White and Yampa Rivers with a description of aquatic environmental parameters, food habits, fish, invertebrates, age and growth, and a comparison of instream flow methodologies.

702. Prewitt, C. G., D. E. Snyder, E. J. Wick, C. A. Carlson, L. Ames, and W. D. Frank. 1977. Baseline survey of aquatic macroinvertebrates and fishes of the Yampa and White Rivers, Colorado. Annu. Rep. U. S. Dep. Inter., Bur. Land Manage. Proj. 31-1474-1744. Dep. Fish. Wildl. Biol., Colorado State Univ., Fort Collins. 64 pp.

ABUNDANCE, AGE-GROWTH, DISTRIBUTION, FISH, FOOD HABITS, GENETICS, HABITAT, INVERTEBRATE, STREAMFLOW, SURVEY, WATER QUALITY

Survey of the White and Yampa Rivers with a description of aquatic environmental parameters, food habits, fish, invertebrates, age and growth, and a comparison of instream flow methodologies.

703. Prewitt, C. G., E. J. Wick, D. E. Snyder, and C. A. Carlson. 1978. Baseline survey of aquatic macroinvertebrates and fishes of the White and Yampa Rivers, Colorado. Semi-annual Report, 19 Jan 1978. Dep. Fish. Wildl. Biol., Colo. State Univ., Fort Collins. 29 pp.

ABUNDANCE, AGE-GROWTH, DISTRIBUTION, FISH, FOOD HABITS, GENETICS, HABITAT, INVERTEBRATE, STREAMFLOW, SURVEY, WATER QUALITY

Survey of the White and Yampa Rivers with a description of aquatic environmental parameters, food habits, fish, invertebrates, age and growth, and a comparison of instream flow methodologies.

704. Price, D., and T. Arnow. 1974. Summary appraisals of the nation's groundwater resources--upper Colorado Region. U. S. Geol. Surv. Prof. Pap. 813-C. 40 pp. + plates and maps.

GEOLOGY, GROUNDWATER, HYDROLOGY, LAW, PRECIPITATION, RIVER-Colorado, WATER QUANTITY

Sources, quantity, and use of water supply in the Upper Colorado Region. Describes the role and potential role of groundwater within the region, compared with other water sources.

705. Price, D., and C. C. Miller. 1975. Hydrologic reconnaissance of the Southern Uinta Basin, Utah and Colorado. Utah Dep. Nat. Resour. Tech. Publ. 49. 66 pp. + plates.

GROUNDWATER, HYDROLOGY, RIVER-Green, WATER RESOURCE, WATER QUALITY

Summarizes the findings of an investigation of the water resources of the southern Uinta Basin conducted by the U. S. Geological Survey in cooperation with the Utah Department of Natural Resources. Evaluates the water resources of the southern Uinta Basin on a reconnaissance level and provides information to assist in future planning and development of the water and related land resources.

706. Price, D., and K. M. Waddell. 1973. Selected hydrologic data in the upper Colorado River basin. U. S. Geol. Surv. Hydrol. Invest. Atlases, HA-477. 2 sheets.

HYDROLOGY, RIVER-Colorado

Atlas provides hydrologic information for the basin.

707. Purdy, W. M. 1962. An outline of the history of the Flaming Gorge area. Univ. Utah Press, Salt Lake City. 42 pp.

HISTORY, RIVER-Green

Brief history of the Flaming Gorge Reservoir site on the Green River.

708. Rabbitt, M. C., D. E. McKee, C. B. Hunt, and L. B. Leopold. 1969. The Colorado River region and John Wesley Powell. U. S. Geol. Surv. Prof. Pap. 669. 157 pp.

GEOLOGY, HISTORY, RIVER-Colorado

Recollection of the works of John Wesley Powell in his early exploration of the Colorado River.

709. Rabe, F. W., III. 1963. Effect of fertilization on four alpine lakes in the Uinta Mountains. Ph. D. Thesis, Univ. Utah, Salt Lake City. 109 pp.

LIMNOLOGY, RIVER-Green

Lakes studied were x-24, x-25, x-26, and x-49, which originate in the Swift Creek drainage of the Green River on the south slopes of the Uinta Mountains. After fertilization, plankton and periphyton increased during the first year and growth of trout increased in shallow lakes during the second year.

710. Rabe, F. W., and J. E. Dyer. 1964. Age and growth study of brook trout from three cirque lakes in the Uinta Mountains. Proc. Utah Acad. Sci. Arts Lett. 41(II): 243-254.

AGE-GROWTH, FISH, LIFE HISTORY, RIVER-Green

Compares the growth and condition of brook trout populations in three high-altitude lakes draining into the Green River.

711. Rabe, F. W., and A. R. Gaufin. 1964. Some limnological effects of fertilizing three cirque lakes in the Uinta Mountains. Proc. Utah Acad. Sci. Arts Lett. 41(II): 255-260.

ALTERATION, LIMNOLOGY, RIVER-Green

Compares the physical, chemical, and biological (plankton) characteristics of three experimental high-altitude lakes in the Green River watershed, before and after fertilization.

712. Radosevich, G. E., and D. H. Hamburg, editors. 1971. Water law and its relationship to environmental quality: a bibliography of source material. Colo. State Univ. Environ. Resour. Cent. Fort Collins, Inf. Ser. 6. 131 pp.

BIBLIOGRAPHY, LAW, WATER QUALITY

Bibliography of water law as related to environmental quality that was prepared for the Colorado Department of Natural Resources, Division of Water Resources, Denver.

713. Rait, M. 1931. Development of Grand Junction and the Colorado River Valley to Palisade from 1881 to 1931. M. S. Thesis, Univ. Colorado, Boulder. 156 pp.

AGRICULTURE, HISTORY, IRRIGATION, MINERAL, SOCIOLOGY, TRANSPORTATION

Describes the history and development of the Grand Junction, Colorado, region from 1881 to 1931, including the fruit industry and farming, coal mining, transportation, cultural, and social life.

714. Rasmussen, J. L. 1970. Atmospheric water balance and hydrology of the upper Colorado River Basin. Water Resour. Res. 6(1): 62-76.

HYDROLOGY, RIVER-Colorado, WATER QUANTITY

Discusses the hydrology of the upper Colorado River Basin.

715. Rathjen, R. A. 1975. The economic base of the Green River Basin in Wyoming. U. S. Dep. Agric. Econ. Res. Serv., Lincoln, Neb. 81 pp.

ECONOMICS, HISTORY, MANAGEMENT, RIVER-Green, SOCIOLOGY

Description of various historical and current economic and social characteristics of the Green River basin in Wyoming. Description and analysis of the basic segments of the basin's economy and a projection of the basin's economy for 1980, 1985, 2000, and 2020.

716. Rechard, P. A., and C. E. Ragsdale. 1971. Compacts, treaties and court decrees: documents on the use and control of Wyoming's interstate streams. Wyoming State Engineer, Cheyenne. 163 pp.

LAW, RIVER-Colorado and tributaries

Documents and summarizes the various laws that pertain to Wyoming's interstate waters, including the interstate compacts (1922 Colorado River Compact; 1948 Upper Colorado River Basin Compact) and the international treaty (1944 Rio Grande, Colorado, Tijuana Treaty with Mexico).

717. Redding, M. J. 1973. Aesthetics in environmental planning. U. S. Environmental Protection Agency, EPA-600/5-73-009. 187 pp.

AESTHETICS, HISTORY, RESOURCES, SOCIOLOGY

Primary emphasis on the interaction between man and the environment and the relationship of aesthetics to environmental planning. Explores the historical development of the Western concept of aesthetics.

718. Reiger, G. 1977. Native fish in troubled waters. Audubon 79(1): 18-41.

DAM, FISH-rare, HISTORY, RESERVOIR

General discussion of the impacts of man-made alterations on various native fish including the Colorado squawfish, humpback chub, humpback sucker, and bonytail chub.

719. Reynolds, P. J., and A. K. Biswas. 1969. Socio-economic simulation for water resource system planning. Proc. Int. Assoc. Hydraul. Res. 13(1): 75-82.

ECONOMICS, MANAGEMENT, POLICY, SOCIOLOGY, WATER QUANTITY

Concludes that efficient allocation of limited natural resources among a variety of competing government programs can be achieved only by the measurement of their relative cost-effectiveness, and this can be done by evaluation of social, political, and economic effects on human beings.

720. Reynolds, R. C., Jr. 1974. Major element geochemistry of Lake Powell. Univ. Calif., Inst. Geophys., Lake Powell Res. Proj. Bull. 5. 13 pp.

LIMNOLOGY, RESERVOIR, RIVER-Colorado

Provides information on the chemical composition of the major elements in Lake Powell.

721. Rhinehart. C. G. 1975. Minimum stream flows and lake levels in Colorado. Colo. State Univ., Environ. Resour. Cent. Inf. Ser. 18. 54 pp. + appendices A-H.

STREAMFLOW, WATER QUANTITY

Purpose was to provide a state-of-the-art report on the "minimum stream flow-lake level" concept as related to the State of Colorado.

722. Richards, L. A., editor. 1954. Diagnosis and improvement of saline and alkali soils. U. S. Dep. Agric., Agric. Handbook 60. 160 pp.

GROUNDWATER, RECLAMATION, SALINITY, SOIL

Reviews the basic principles for improving and managing soils in the arid and semi-arid regions of the U. S. as related to salinity and alkali. Also reviews soil water and quality of irrigation water.

723. Richardson, G. B. 1909. Reconnaissance of the Book Cliffs coal field between Grand River, Colorado, and Sunnyside, Utah. U. S. Geol. Surv. Bull. 371. 54 pp.

ENERGY, MINERAL, RIVER-Colorado, SURVEY

Survey of the Book Cliffs coal resources.

724. Richardson, W. M., editor. 1976. Fishes known to be in the Colorado River drainage. Pages 12-18 in Technical Committee minutes, Colorado River Wildlife Council, Las Vegas, Nevada.

FISH, RIVER-Colorado

A lising of fish by family, common name, and scientific name with range and remarks, such as whether they are introduced or native.

725. Riesboe, H. S., W. L. Minckley, and R. F. Kilmarten. 1971. Lake Powell quality studies for the Navajo Plant. Paper presented at 1971 Am. Soc. Civil Eng. Nat. Water Resources Eng. Meeting, Phoenix, Ariz., 12 January 1971. 48 pp. + 10 figs.

FISH, INVERTEBRATES, RIVER-Colorado, WATER QUALITY

Purpose of the study was to determine the adverse effects, if any, of the blowdown water from cooling towers on the aquatic environment.

726. Rinne, J. N. 1969. Cyprinid fishes of the genus Gila from the lower Colorado River Basin. M. S. Thesis, Arizona State Univ., Tempe. 77 pp.

AGE-GROWTH, DISTRIBUTION, ECOLOGY, FISH, HABITAT, RIVER-Colorado

Cyprinid fishes of the genus Gila from the lower Colorado River were studied according to their individual and geographic variations. Emphasis was on temporal and spatial stabilities, habitat conditions, and the correspondence of observed patterns of variation to drainage histories and ecological information.

727. Rinne, J. N. 1976. Cyprinid fishes of the genus Gila from the lower Colorado River basin. Wasmann J. Biol. 34(1): 65-107.

DISTRIBUTION, FISH, FISH-rare, RIVER-Colorado

Reviews the taxonomy, evolution, and distribution of the genus Gila in the lower Colorado River basin. Two species, G. elegans and G. robusta, are also found in the upper basin. An artificial key to the genus Gila is presented.

728. Riter, J. R. 1956. Determination of the hydroelectric energy sources of a river basin. Paper presented at Symp. World Power, Vienna, Austria, 1956. 14 pp.

ENERGY, RESOURCES, RIVER-Colorado

Discusses the potential and existing hydroelectric plant sites on the Colorado River. Manuscript available at the U. S. Bureau of Reclamation Library, Denver, Colorado.

729. Rivkin/Carson, Inc. 1973. Economic development and water resource investments. Final Rep., Dep. Inter., Bur. Reclam., Washington, D. C. Contract 14-06-D-7336. 408 pp.

ECONOMICS, POPULATION, WATER RESOURCE

Documents population growth and water resource development in subregions of Arizona, Colorado, New Mexico, and Utah. Provides case studies and documents the economics of water resource investments.

730. Rizvin, S. S. A. 1967. Investigation of water supply depletion in the upper Colorado River Basin. Ph. D. Thesis, Univ. Colorado, Boulder. 142 pp.

IRRIGATION, MODEL, RIVER-Colorado, WATER QUANTITY

Regression analysis and mathematical models of water withdrawals and irrigation requirements from the Colorado River.

731. Robbins, D. W. 1976. Quantification of instream flow needs by law in Colorado. Pages 184-203 in J. F. Orsborn and C. H. Allman, eds. Proceedings of a symposium and specialty conference on instream flow needs. Vol. 1. Am. Fish. Soc., Washington, D. C.

LAW, STREAMFLOW

Reviews Colorado Senate Bill 97 that proposes to redefine the words "diversion" and "beneficial use"; these changes could allow for preservation of natural environments from diversions from Colorado streams.

732. Robertsons, B. A. 1977. Aquatic inventory -- Mancos River system; Animas--La Plata project. U. S. Fish and Wildlife Service, Gallup, New Mexico. 9 pp.

FISH, INVERTEBRATE, RIVER-San Juan tributary, SURVEY

Survey of the Mancos River and its major tributaries for fish, invertebrates, and water quality.

733. Robinson, A. R. 1970. Sediment, our greatest pollutant? Am. Soc. Agric. Eng., Pap. 70-701. 15 pp.

POLLUTION, SEDIMENT

Research at the U. S. Department of Agriculture Sedimentation Laboratory and other locations provides insight on the pollution aspects of sediment, including its role as a carrier or scavenger of other pollutants.

734. Robinson, D. J. 1978. Report on the collection of Colorado River squawfish brood stock. Admin. Rep., Area Office, U. S. Fish Wildl. Serv., Salt Lake City, Utah. 6 pp.

FISH-rare, RIVER-Green

Summarizes sampling for Colorado squawfish in the Green River during 1978.

735. Rogers, G. E. 1974. Effects of oil shale development on wildlife. Proc. Annu. Conf. West. Assoc. State Game Fish Comm. 54: 165-179.

ENERGY, MINERAL, WILDLIFE

Brief account of the potential impact of the development of oil shale on wildlife.

736. Roggenbuck, J. W. 1975. Socio-psychological inputs into carrying capacity assessments for float-trip use of whitewater rivers in Dinosaur National Monument. Ph. D. Thesis, Utah State Univ., Logan. 309 pp.

MANAGEMENT, POLICY, POPULATION, RECREATION, RIVER-Green, Yampa, SOCIOLOGY, SURVEY

An examination of socio-psychological inputs to decisions regarding the carrying capacity of the Green and Yampa Rivers in Dinosaur National Monument for float-trip use. A questionnaire was developed to ascertain the trip motives, preferences, and satisfaction of river users.

737. Rosenlund, B. D. 1974. Myxosoma spores. U. S. Gov. Memo. to Dr. G. L. Hoffman, Eastern Fish Disease Lab., Leetown, W. Va. U. S. Fish Wildl. Serv., Alchesay-Williams Creek Natl. Fish Hatch., Whiteriver, Ariz. 10 July. 1 p.

FISH-rare

Documents Ichthyophthirius and Myxosoma in a Colorado squawfish from the Willow Beach National Fish Hatchery and Myxosoma and Lernaea in razorback suckers from Lake Mohave.

738. Rosenlund, B. D. 1975. Letter to Dr. Wendell Minckley, Arizona State Univ., Flagstaff. U. S. Fish Wildl. Serv. Alchesay-Williams Creek Natl. Fish Hatch., Whiteriver, Ariz. 2 May. 3 pp.

FISH-rare

Razorback suckers collected from Lake Mohave in the lower Colorado River contained parasites of the genera Ichthyophthirius, Lernaea, and Myosoma; an unidentified monogenetic trematode of the suborder Polyopistocotyles;and pathogenic bacteria of the genera Aeromonas and Pseudomonas.

739. Ruff, J. F. 1967. Final report of hydraulic model study of Green River fish barrier dam fish trap. Colo. State Univ., Eng. Res. Center, Civil Eng. Dep., Fort Collins. 15 pp.

FISH, MIGRATION, RIVER-Green

Presents the scope and criteria of the model study, with conclusions and recommendations. This is the second of two parts.

741. Sartoris, J. J. 1976. A mathematical model for predicting river temperatures--application to the Green River below Flaming Gorge Dam. U. S. Bur. Reclam., Eng. Res. Center, Denver, Colo. REC-ERC-76-7. 28 pp.

MODEL, RIVER-Green, TEMPERATURE, WATER QUALITY

Computerized, mathematical model to evaluate the effect of modifications to Flaming Gorge Dam for selective water withdrawal on water temperatures in the Green River downstream from the Dam. The computer model could be adapted to a variety of data and stream conditions.

742. Sawyer, J. W., Jr., F. L. Brown, and D. Abbey. 1980. Energy development scenarios for the four corners states and the upper Colorado River Basin. Chapter 3 in W. O. Spofford, Jr., A. L. Parker, and A. V. Kneese, eds. Energy development and the water, fish, and wildlife in the Southwest: Problems of the upper Colorado River basin. Resources for the Future, Washington, D. C. In press.

ENERGY, POLICY, RIVER-Colorado

Provides four energy development scenarios for the states in the Four Corners area of the Intermountain West with projections for generation of electricty, synthetic natural gas from coal (coal gasification), crude oil from oil shale, and uranium mining.

743. Schleusener, R. A., and L. W. Crow. 1961. Analysis of precipitation data in the Upper Colorado River Basin. Colo. State Univ., Dep. Atmos. Sci. Tech. Pap. 18, and Natl. Tech. Info. Serv., Springfield, Va. PB-213 999/6. 68 pp.

PRECIPITATION, RIVER-Colorado, RUNOFF, WEATHER

An analysis of daily precipitation and temperature data from 30 weather observing locations in or near the Upper Colorado River Basin. Major storms having a recurrence less than once per year contribute significantly to runoff in the Upper Colorado River.

744. Schreiner, K. M. 1977. Federal view of "realistic" endangered species administration and management. Proc. Annu. Conf. Western Assoc. Game Fish Comm. 57: 291-297.

FISH-rare, MANAGEMENT, RESOURCES

Summarizes the federal viewpoint of realistic administration and management of endangered species including the sociological, political, and economical factors.

745. Schrenkeisen, R. 1938. Field book of fresh-water fishes of North America north of Mexico. G. P. Putnam's Sons, New York. 312 pp.

DESCRIPTION, DISTRIBUTION, FISH, LIFE HISTORY

List of freshwater fishes of North America with scientific and common names, physical descriptions, distribution, and life history.

746. Schulze, W., S. Ben-David, D. Brookshire, and R. Whitworth. 1975. The macroeconomic impact of energy development in the Lake Powell area. Univ. Calif., Inst. Geophys., Lake Powell Res. Proj. Bull. 11. 16 pp.

ECONOMICS, ENERGY, MINERAL, RESERVOIR, RIVER-Colorado

Reviews the possible impacts of energy development in the Lake Powell area.

747. Schumm, S. A. 1960. The shape of alluvial channels in relation to sediment type. U. S. Geol. Surv. Prof. Pap. 352-B: 17-30.

RUNOFF, SEDIMENT, STREAMFLOW

Provides some principles in the width and depth of stream channels as influenced by sediment type.

748. Schumm, S. A. 1961. Effect of sediment characteristics on erosion and deposition in ephemeral-stream channels. U. S. Geol. Surv. Prof. Pap. 352-C: 31-70.

EROSION, SEDIMENT, STREAMFLOW

Emphasizes the importance of physical properties of sediment in determining stream-channel shape and differences in the mechanics of erosion and deposition between areas.

749. Schumm, S. A. 1975. Evaluation of the storage mechanisms of diffuse sources of salinity in the upper Colorado River basin. Sci. Technol. Aerosp. Rep. 13(3): P-38.

RIVER-Colorado, SALINITY

Provides aerial photographs of the Colorado River and evaluates storage as a mechanism to reduce salinity in the river.

750. Sealing, C. 1974. Regional fishery inventory: Northwest regional lake and stream studies. Colorado Div. Wildl., Denver. Fed. Aid Proj. F-030-R-11/Job 04/FIN. 30 pp.

FISH, FISH-rare, RIVER-Colorado, SURVEY

Provides data on the distribution and life history of fish, including the Colorado squawfish, an endangered species.

751. Sealing, C., G. Kidd, B. Burdick, R. Sutton, K. McMaster, and M. Japhet. 1975. Regional fishery inventory: Northwest region lake and stream studies. Colorado Div. Wildl., Denver. Fed. Aid Proj. F-030-R-11/Job 04-FIN. 31 pp.

FISH, FISH-rare, RIVER-Colorado, SURVEY

Provides data on the distribution and life history of fish, including the bonytail and humpback chubs, humpback suckers, and Colorado squawfish, which are scarce and are classified as endangered or have been suggested for consideration as being threatened or endangered.

752. Sears, J. D. 1962. Yampa Canyon on the Uinta Mountains, Colorado. U. S. Geol. Surv. Prof. Pap. 374-I. 33 pp. + maps and plates.

GEOLOGY, RIVER-Yampa

Discusses unusual features found in the area and the possible origin and development of the Canyon.

753. Seastone, D. A., and L. M. Hartman. 1963. Alternative institutions for water transfer: the experience in Colorado and New Mexico. Land Econ. 39(1): 31-43.

LAW, WATER RESOURCE

Reviews the administrative process and judicial problems concerning water transfers in Colorado and New Mexico.

754. Seethaler, K. 1975. Résumé of current knowledge on Colorado squawfish. Report to the Colorado Squawfish Recovery Team. Utah Coop. Fish. Res. Unit, Utah State Univ., Logan. 11 pp. (Unpubl. manuscr.)

ABUNDANCE, BIBLIOGRAPHY, DISTRIBUTION, FISH, RIVER-Colorado

Brief summary of the current status of the Colorado squawfish, its abundance, distribution, and possible causes for the decline. Current and previous studies are described. A short bibliography on the species is included.

755. Seethaler, K. 1976. Report to the Colorado Squawfish Recovery Team on the distribution and movement of the Colorado squawfish (Ptychocheilus lucius) as a preliminary to future migration studies. Report to Colorado Squawfish Recovery Team. Utah Coop. Fish. Res. Unit, Utah State Univ., Logan. 13 pp. (Unpubl. manuscr.)

BIBLIOGRAPHY, DISTRIBUTION, FISH-rare, MIGRATION, MOVEMENT, RIVER-Colorado, Green, Yampa

Report on the current knowledge of the movement of Colorado squawfish, experience with sonic tagging of this species, and a summary and selected bibliography on sonic and radio tagging of fish.

756. Seethaler, K. 1978. Life history and ecology of the Colorado squawfish (Ptychocheilus lucius) in the upper Colorado River basin. M. S. Thesis, Utah State Univ., Logan. 155 pp.

ABUNDANCE, AGE-GROWTH, DESCRIPTION, DISTRIBUTION, ECOLOGY, FISH-rare, FOOD HABITS, HABITAT, HISTORY, LIFE HISTORY, MANAGEMENT, MOVEMENT, RIVER-Colorado, Green, Yampa

A broad and comprehensive synthesis of all current knowledge on the Colorado squawfish including distributon, abundance, habitat requirements, systematics, reproduction, early life development, age and growth, food habits, movement, maturity, disease and parasites, and causes for its decline. This document contains a bibliography of all original studies that have been made on this species to date.

757. Seethaler, K. H., C. W. McAda, and R. S. Wydoski. 1979. Endangered and threatened fish in the Yampa and Green Rivers of Dinosaur National Monument. Pages 605-612 in R. M. Linn, ed. Proceedings of the first conference on scientific research in national parks. U. S. Dep. Inter., Natl. Park Serv., Trans. Proc. Ser. 5.

ABUNDANCE, DAM, DISTRIBUTION, FISH, LIMNOLOGY, RESERVOIR, RIVER-Green, Yampa, TEMPERATURE, WATER QUALITY

Summary of knowledge of four threatened or endangered fish species (Colorado squawfish, humpback chub, bonytail chub, and humpback sucker) in the Green and Yampa Rivers of Dinosaur National Monument. Paper was presented at the First Conference on Research in the National Parks in the fall of 1976.

758. Sersland, H. N. 1977. Fish and wildlife mitigation on U. S. Bureau of Reclamation projects, Upper Colorado Region - past and future. Proc. Annu. Conf. Western Assoc. Game Fish Comm. 57: 257-262.

ECONOMICS, FISH, HISTORY, LAW, RECLAMATION, RIVER-Colorado, WATER QUANTITY

Reviews the historical development of Bureau of Reclamation projects on the upper Colorado River and discusses the changes in philosophy and policy regarding water, fish, and wildlife resources of this region.

759. Sharma, R. K. 1973. Fish protection at water diversions and intakes: a bibliography of published and unpublished references. U. S. Environ. Protect. Agency, Argonne Natl. Lab., Argonne, Illinois. 35 pp.

BIBLIOGRAPHY, FISHERY

Bibliography with key words on guiding fish at water diversions and screening them from water intakes.

760. Sharpe, F. P. 1959. Investigation of Shadow Mountain trout fishery: estimate of trout populations. Colo. Game, Fish, Parks Dep., Denver. Fed. Aid Proj. F-025-R-02/Job 02. 32 pp.

ABUNDANCE, DISTRIBUTION, FISH, LIFE HISTORY, RIVER-Colorado basin, WATER QUALITY

Provides information on the distribution and abundance of coldwater and warmwater fish species in Shadow Mountain Reservoir in Grand County, Colorado River basin. Also provides information on the food and movements of fish in the reservoir.

761. Sharpe, F. P., M. Elkins, and P. Strauss. 1979. A case history -- Unscheduled fish and wildlife mitigation: PL93-320, Title I, Colorado River Basin salinity control project. Pages 301-304 in G. A. Swanson, technical coordinator. The mitigation symposium: a national workshop in mitigating losses of fish and wildlife habitats. U. S. Forest Serv., Gen. Tech. Rep. RM-65.

ALTERATION, FISH HABITAT, LAW, RIVER-Colorado, WILDLIFE

Subsequent to water development authorization, an Ad Hoc Committee was established by U. S. Bureau of Reclamation to mitigate habitat loss in Arizona and California resulting from the Colorado River Basin Salinity Control Act, while dealing with the sensitive issues of water scarcity, endangered species, and state and national boundaries.

762. Shown, L. M. 1970. Evaluation of a method for estimating sediment yield. Pages 245-249 in Geological Survey Research 1970, Chapter B. U. S. Geol. Surv. Prof. Pap. 700-B. 265 pp.

CLIMATE, EROSION, GEOLOGY, HYDROLOGY, RUNOFF, SEDIMENT, SOIL

Reports results of tests in 28 small watersheds in arid and semi-arid areas of western Colorado, north-central New Mexico, and east-central Wyoming, representing a variety of geologic, climatic, ecologic, and topographic conditions. Method was designed to make general sediment classifications.

763. Siegfried, J. F. 1927. Geology of the Colorado River from Moab, Utah, to the inflow of the Green River. M. S. Thesis, Univ. Utah, Salt Lake City. 74 pp.

GEOLOGY, RIVER-Colorado, Green

Gives the geologic history of the region near or at the confluence of the Colorado and Green Rivers in southern Utah.

764. Sigler, W. F., W. T. Helm, J. W. Angelovic, D. W. Linn, and S. S. Martin. 1966. The effects of uranium mill wastes on stream biota. Utah Agric. Exp. Stn. Bull. 462. 76 pp.

INSECT, MINERAL, POLLUTION, RIVER-Dolores, VEGETATION, WATER QUALITY

Radium, a radioactive material found in water and bottom sediments of the Animas, San Miguel, and Dolores Rivers, limited or extirpated the aquatic biota below uranium mills. Information on other non-radioactive materials from uranium mill wastes was collected on sulfates, nitrates, chlorides, manganese, iron, lead, arsenic, and organics. Bottom fauna studies in the Animas River in summer 1958 showed virtual elimination of life immediately below Durango and severe damage as far downstream as 50 miles. Insects, algae, and fish were rarely present at the collecting stations on the lower San Miguel River, but abundance of biotic components increased on the lower Dolores River. Also contains other references pertaining to the effects of uranium mill wastes on aquatic organisms in these rivers.

765. Sigler, W. F., and R. R. Miller. 1963. Fishes of Utah. Utah State Dep. of Fish and Game, Salt Lake City. 203 pp.

ABUNDANCE, DESCRIPTION, DISTRIBUTION, ECOLOGY, FISH, FOOD HABITS, LIFE HISTORY

Gives aspects of the life history, ecology, distribution, and abundance of fishes found in the State of Utah, including those in the Colorado River Basin.

766. Simon, J. R. 1935. A survey of the waters of the Wyoming National Forest. U. S. Bur. Fish., Washington, D. C. 28 pp.

FISH, LIMNOLOGY, RIVER-Green, SURVEY, TEMPERATURE, WATER QUALITY

Survey of the National Forests in Wyoming in 1934. Includes information on the lakes and streams, including fish present, alkalinity, water flow, temperature, and approximate drainage area for the Green River and its tributaries and other waters of Wyoming.

767. Simons, D. B. 1975. The geomorphic and hydraulic response of rivers. Trans. N. Am. Wildl. Nat. Resour. Conf. 40: 209-219.

HYDROLOGY, MODEL, STREAMFLOW

Presents elements of fluvial geomorphology and hydraulics that are related to the interpretation and modeling of response of alluvial rivers to natural and man-made causes.

768. Simpson, J. C. 1941. Food analysis of some important species of Wyoming forage fishes. M. S. Thesis, Univ. Wyoming, Laramie. 81 pp.

FISH, FOOD HABITS, RIVER-Green

Includes fish collection below Black's Fork in the Green River and other locations in Wyoming. Food habits are given for white sucker, mountain sucker, Utah chub, creek chub, redside shiner, longnose dace, speckled dace, and carp.

769. Singh, R. N., and K. Wilkinson. 1968. Social science studies of water resources problems: review of literature and annotated bibliography. Mississippi State Univ., Water Resour. Res. Inst. 86 pp.

BIBLIOGRAPHY, MANAGEMENT, SOCIOLOGY, WATER QUANTITY

Bibliography relating sociology to water resource development.

770. Sinning, J. A., and J. W. Andrew. 1979. Habitat enhancement for Colorado squawfish in the Yampa River in conjunction with railroad construction. Pages 553-555 in G. A. Swanson, technical coordinator. The mitigation symposium: a national workshop in mitigating losses of fish and wildlife habitats. U. S. Forest Serv., Gen. Tech. Rep. RM-65.

ALTERATION, FISH-rare, HABITAT, RIVER-Yampa, TRANSPORTATION

Proposed alterations to the Yampa River that would enhance the habitat for the Colorado squawfish and, at the same time, allow railroad construction along the river.

771. Skogerboe, G. V., and W. R. Walker. 1972. Evaluation of canal lining for salinity control in Grand Valley. Technol. Ser., Office Res. Monit., U. S. Environ. Protect. Agency. Washington, D. C. 213 pp.

AGRICULTURE, GROUNDWATER, HYDROLOGY, IRRIGATION, MANAGEMENT, SALINITY, SOIL

An evaluation of the salinity control effectiveness of canal and lateral linings for reduction of seepage and deep percolation losses into the groundwater. These losses to the saline soils and aquifers, and the eventual return of these flows to the river system with large salt loads, is a significant salinity source in the Upper Colorado River Basin.

772. Skogerboe, G. V., and W. R. Walker. 1975. Salinity policy for Colorado River basin. J. Hydraul. Div., Am. Soc. Civ. Eng. 101(8): 1067-1075.

POLICY, RIVER-Colorado, SALINITY

Provides ideas on a policy concerning the salinity of the Colorado River.

773. Skogerboe, G. V., W. R. Walker, R. S. Bennett, J. E. Ayars, and J. H. Taylor. 1974. Evaluation of drainage for salinity control in Grand Valley. Environ. Protect. Tech. Ser. Office Res. Develop., U. S. Environ. Protect. Agency, Washington, D. C. 109 pp.

AGRICULTURE, HYDROLOGY, IRRIGATION, MANAGEMENT, SALINITY, SOIL, VEGETATION

A study to identify drainage needs and the effect field relief drainage would have on reducing salinity in irrigation return flows.

774. Skogerboe, G. V., W. R. Walker, J. H. Taylor, and R. S. Bennett. 1974. Evaluation of irrigation scheduling for salinity control in Grand Valley. U. S. Environ. Protect. Technol. Ser. Office Res. Devel., U. S. Environ. Protect. Agency, Washington, D. C. 94 pp.

AGRICULTURE, CLIMATE, HYDROLOGY, IRRIGATION, MANAGEMENT, SALINITY, SOIL, VEGETATION

A study on irrigation scheduling for salinity control. Early-season irrigations are shown to provide significantly more salts to the river system than later ones. Evapotranspiration and available root zone soil moisture are important considerations.

775. Skogerboe, R. K., C. S. Lavallee, M. M. Miller, and D. L. Dick. 1979. Environmental effects of western coal surface mining. Part III - The water quality of Trout Creek, Colorado. U. S. Environ. Protect. Agency, EPA-600/3-79-008. 68 pp.

ENERGY, MINERAL, POLLUTION, WATER QUALITY

The impact of the mine spoil drainage on the stream is reflected in the larger quantities of dissolved solids and common ions found at on-stream sites adjacent to and below mining operations. Levels of gross factors (e. g., specific conductivity), the common ions (e. g., calcium and sulfate), and some trace components (e. g., selenium) are highest in the mine spoil drainages. For trace elements, mining had no detectable impact on Trout Creek in terms of increasing concentrations of Al, As, Cd, Cr, Cu, Fe, Pb, and Zn. However, increases in the concentrations of Mn and Se in the stream were attributed to mine inflow. Higher concentrations of As, Fe, Mn, Se, and Zn are found in waters draining mine spoils.

776. Skogerboe, R. K., C. S. Lavellee, M. M. Miller, and D. L. Dick. 1979. Environmental effects of oil shale mining and processing. Part III - The water quality of Piceance Creek, Colorado, prior to oil shale processing. U. S. Environmental Protection Agency, Publ. EPA-600/3-79-055. 69 pp.

ENERGY, LIMNOLOGY, RIVER-White tributary, WATER QUALITY

Water quality data were collected at seven sites along Piceance Creek and at one site each along Stewart, Black Sulphur, and Yellow Creeks in the Piceance Basin, Colorado, during 1975-77. The preoperational water quality is generally poor due to higher levels of dissolved solids (contributed to by calcium, magnesium, sodium, bicarbonate, sulfate, chloride, and potassium), manganese, and both dissolved and suspended iron. The concentrations of aluminum, cadmium, chromium, lead, and boron were below the detection limits of the analysis method used and, therefore, below the permissible levels set for aquatic life by factors of 5-10. The levels of copper, zinc, arsenic, selenium, and mercury were usually measurable but still below permissible levels. Natural conditions (pH between 7.5 and 8.5 and carbonate alkalinity between 300 and 800 mg $CaCO_3$ per liter) should limit the solubilities of most metals to levels below the criteria standards set for the protection of aquatic life.

777. Sladek, T. A. 1974. Recent trends in oil shale. Part 1: History, nature, and reserves. Colo. School Mines, Golden. Miner. Ind. Bull. 17(6): 1-20. Part 2: Mining and shale oil extraction processes. Colo. School Mines, Golden. Miner. Ind. Bull. 18(1): 1-20. 1974. Part 3: Shale oil refining and oil shale problems. Colo. School Mines, Golden. Miner. Ind. Bull. 18(2): 1-11, 1975.

DISTRIBUTION, HISTORY, MINERAL

Reviews the history of oil shale trends and provides a summary of reserves. Also reviews extraction, refining, and other problems of oil shale.

778. Smith, D. A. 1977. State view of endangered species management. Proc. Annu. Conf. Western Assoc. Game Fish Comm. 57: 287-290.

FISH-rare, MANAGEMENT, RESOURCES

Summarizes the problems associated with the Endangered Species Act of 1973 in regard to the realistic management of all game and nongame species including endangered species at the state level.

779. Smith, F. A. 1973. Mercury, dieldrin, DDT, DDE, and PCB levels in tissues from fish and wildlife, in Utah. M. S. Thesis, Utah State Univ., Logan. 119 pp.

POLLUTION, WILDLIFE

Fish and wildlife were randomly sampled in Utah from preselected areas and analyzed for levels of total mercury, dieldrin, DDT, and DDE. Concentrations were well within consumptive tolerance or guideline limits, except for mercury in fish of Willard Bay Reservoir. PCB's were also identified in a large proportion of the samples. The only animals sampled in Colorado River drainage were pheasants.

780. Smith, G. R. 1959. Annotated checklist of fishes of Glen Canyon. Pages 195-199 in Charles E. Dibble, ed. Ecological studies of the flora and fauna in Glen Canyon. Univ. Utah Anthropol. Pap. 40. Glen Canyon Ser. 7.

FISH, RIVER-Colorado

List of fish collections made by the University of Utah in Glen Canyon, 30 June to 8 August 1958.

781. Smith, G. R. 1960. Annotated list of fishes of the Flaming Gorge Reservoir basin, 1959. Pages 163-168 in A. M. Woodbury, ed. Ecological studies of the flora and fauna of Flaming Gorge Reservoir basin, Utah and Wyoming. Univ. Utah, Dep. Anthropol., Anthropol. Pap. 48, Upper Colo. Basin Ser. 3.

DISTRIBUTION, FISH, RIVER-Green

Lists and describes fishes and natural resources found in the Flaming Gorge of the Green River in a survey conducted in summer 1959.

782. Smith, G. R. 1966. Distribution and evolution of the North American catostomid fishes of the subgenus *Pantosteus*, genus *Catostomus*. Misc. Publ. Mus. Zool. Univ. Mich. 129. 133 pp.

DESCRIPTION, DISTRIBUTION, ECOLOGY, FISH

Describes the morphological characteristics of fish of the subgenus *Pantosteus* and discusses the reasoning behind the reclassification of fish of the genus *Pantosteus* into the genus *Catostomus*. Also gives distribution and habitat requirements of these fish.

783. Smith, G. R., G. Musser, and D. B. McDonald. 1959. Pages 177-194 in C. E. Dibble, ed., Ecological studies of the flora and fauna in Glen Canyon. Appendix A. Aquatic survey tabulation. Univ. Utah Anthropol. Pap. 40. Glen Canyon Ser. 7.

FISH, INVERTEBRATE, LIMNOLOGY, RIVER-Colorado

Location and physical characteristics of collection sites and fishes and insects collected by the University of Utah in Glen Canyon from 30 June to 8 August 1958.

784. Smith, J. H. 1949. The economic impact of the development of the Upper Colorado River Basin in Colorado. M. A. Thesis, Univ. Colorado, Boulder. 253 pp.

ECONOMICS, MANAGEMENT, RIVER-Colorado

Discusses the impact of development and economics of development in the Upper Colorado River Basin.

785. Smith, M. H., H. O. Hillstead, M. V. Manlove, and R. L. Marchinton. 1976. Use of population genetics data for the management of fish and wildlife populations. Trans. N. Am. Wildl. Nat. Resour. Conf. 41: 119-133.

FISH, GENETICS, POPULATION, WILDLIFE

Reviews the importance of population genetics in the management of fish and wildlife populations. Population genetics should be an important consideration in the management and restoration of threatened or endangered species such as those in the upper Colorado River basin.

786. Smith, N. F. 1976. Aquatic inventory: Animas-La Plata Project. Colo. Dep. Nat. Resour., Div. Wildl., Denver. 316 pp.

FISH, FISHERY, INSECT, INVERTEBRATE, RIVER-San Juan tributary, STREAMFLOW, SURVEY, TEMPERATURE, WATER QUALITY

Describes detailed aquatic inventory of the Animas-La Plata Project of the U. S. Bureau of Reclamation. The entire Animas River and tributaries were inventoried from Silverton, Colorado, to the Colorado-New Mexico state line. The La Plata drainage was completely surveyed from its headwaters at Kennebec Pass south to the state line. The Mancos River was inventoried from Mancos, Colorado, south and west through the Ute Mountain Indian Reservation to the state line.

787. Smith, N. F. 1977. Aquatic inventory: San Miguel Project. Colo. Dep. Nat. Resour., Div. Wildl., Denver. 193 pp.

FISH, FISHERY, INVERTEBRATE, RIVER-Dolores tributary, STREAMFLOW, SURVEY, WATER QUALITY

Describes an aquatic inventory of the San Miguel River from Telluride, Colorado, to the confluence with the Dolores River below Uravan, Colorado. Provides data on the sport fishery, fish, and invertebrates as well as physical data on streamflow and water quality.

788. Smith, R. A. 1980. Predicting the impacts of surface coal mining on trout populations in the Yampa River basin. Chapter 14 in W. O. Spofford, Jr., A. L. Parker, and A. V. Kneese, eds. Energy development and the water, fish, and wildlife in the Southwest: Problems of the upper Colorado River basin. Resources for the Future, Washington, D. C. In press.

FISH, MINERAL, POPULATION, RIVER-Yampa

Describes a method involving two models for estimating the impact of surface coal mining and different land reclamation practices on trout populations in stream draining proposed strip mining areas with a discussion of such impacts on the Yampa River.

789. Smith, R. J., and associates. 1965. Water resources inventory, Wyoming Water Division No. 4 including Green River, Bear River, Snake River Drainages and Red Desert Basin and the Little Snake River Drainage in Water Division No. 1. R. J. Smith and Assoc. (Consulting Engineers), Rawlins, Wyoming, for Wyoming State Engineer, Cheyenne. 43 pp.

RIVER-Green, Little Snake, SURVEY, WATER QUANTITY

Inventory of the water supply in the Green and Little Snake Rivers in Wyoming.

790. Snyder, D. E., M. B. M. Snyder, and S. C. Douglas. 1977. Identification of golden shiner, *Notemigonus crysoleucas*, spotfin shiner, *Notropis spilopterus*, and fathead minnow, *Pimephales promelas*, larvae. J. Fish. Res. Board Canada 34(9): 1397-1409.

DESCRIPTION, FISH

Illustrations, morphometrics and meristics, and discussion on the development of larval stages of three minnows. The fathead minnow is locally common in the upper Colorado River basin.

791. Snyder, G. R., and H. A. Tanner. 1960. Cutthroat trout reproduction in the inlets to Trappers Lake. Colo. Game, Fish, Parks Dep., Denver. Fed. Aid Proj. F-018-R and Tech. Bull. 7. 95 pp.

FISH, LIFE HISTORY, MANAGEMENT

Provides data on the sex ratio, fecundity, and spawning of cutthroat trout in Trappers Lake, Garfield County, Colorado.

792. Snyder, J. O. 1915. Notes on a collection of fishes made by Dr. Edgar A. Mearns from rivers tributary to the Gulf of California. Proc. U. S. Natl. Mus. 49: 573-586.

DISTRIBUTION, FISH, HISTORY, RIVER-Colorado, SURVEY

Compilation of notes from the Mexican boundary survey between January 1892 and September 1894. Dr. Mearns collected native fish from the Colorado, Sonoyta, Altar, and Yaqui Rivers.

793. Soil Conservation Service. 1975. Erosion, sediment, and related salt problems and treatment opportunities. U. S. Dep. Agric., Soil Conserv. Serv., Golden, Colo. 152 pp.

EROSION, SALINITY, SEDIMENT, WATER QUALITY

This report is intended as a regional and state assessment of erosion, sediment, and related salt problems showing (1) sediment yield rates which are occurring, (2) data related to erosion, sediment, and salt loading, (3) critical source areas affecting water quality, (4) types, cost, and location of treatment potential, and (5) impacts of erosion control and sediment and salt reduction on land and water quality, water development and management. State evaluations include Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. This report was written for the Western United States Water Plan (Westwide Study).

794. Sparrowe, R. D., and H. M. Wight. 1975. Setting priorities for the endangered species program. Trans. N. Am. Wildl. Nat. Resour. Conf. 40: 142-156.

MANAGEMENT, WILDLIFE

Methods of review to determine the population status, vulnerability, recovery potential, and special attributes of threatened or endangered species.

795. Spofford, W. O., Jr. 1980. Potential impacts of energy development on streamflows in the upper Colorado River basin. Chapter 6 in W. O. Spofford, Jr., A. L. Parker, and A. V. Kneese, eds. Energy development and the water, fish, and wildlife in the Southwest: Problems of the upper Colorado River basin. Resources for the Future. Washington, D. C. In press.

ENERGY, MANAGEMENT, RIVER-Colorado, STREAMFLOW

Because of the dynamic nature of the upper basin, sufficient information was not available to assess the extent of impacts on streamflow in the upper basin. Monthly flow analyses will not be sufficient for most of the reaches of the upper Colorado River to estimate the impact of energy development on streamflows. Hydrologic simulations employing daily flows during low streamflows will be necessary for such analyses.

796. Stalnaker, C. B., and J. L. Arnette. 1976. Methodologies for the determination of stream resource flow requirements: an assessment. U. S. Fish Wildl. Serv., Office of Biol. Serv., West Water Allocation, Washington, D. C. 199 pp.

AESTHETICS, FISH, INVERTEBRATE, RECREATION, STREAMFLOW, WATER QUALITY, WATER QUANTITY, WILDLIFE

A state-of-the-art report on methodologies for determining streamflow requirements for aquatic life, wildlife, water quality, recreation, and aesthetics. Provides recommendations for research needs involving streamflow requirements.

797. Stalnaker, C. B., and P. B. Holden. 1973. Changes in the native fish distribution in the Green River system, Utah-Colorado. Proc. Utah Acad. Sci. Arts Lett. 51(Part 1): 25-32.

ABUNDANCE, FISH, FISH-rare, RIVER-Green

Documents the decline in relative abundance and distribution of four endemic fish in the Green River. Also gives the distribution and relative abundance of three other endemic fish that are still found in relatively high numbers.

798. Standiford, L., D. Potter, and D. E. Kidd. 1973. Mercury in the Lake Powell ecosystem. Univ. Calif., Inst. Geophys. Lake Powell Res. Proj. Bull. 1. 21 pp.

FISH, INVERTEBRATE, MINERAL

Mercury levels (in parts per billion) determined by flameless atomic absorption analyses yielded the following results: 0.01 in lake water, 30 in bottom sediments, 10 in shoreline substrates, 34 in plant leaves, 145 in plant debris, 28 in algae, 10 in crayfish, and 232 in fish muscle. The bioamplification of this element was evident in this recently formed and relatively unpolluted reservoir.

799. Standing, K. M. 1954. A critical study of the genus Pantosteus (Catostomidae). M. S. Thesis, Brigham Young Univ., Provo, Utah. 51 pp.

DESCRIPTION, DISTRIBUTION, FISH

States that the characteristics (size of predorsal scales, thickness of the cranium, size of the opening of the fontanelle) used to differentiate the genus Notolepedomyzon from Pantosteus are not consistent and that Notolepedomyzon is not a valid genus. However, also states that there is enough difference in characteristics to separate Pantosteus into subgenera--Pantosteus and Notolepedomyzon.

800. Stanton, T. W. 1893. The Colorado Formation and its invertebrate fauna. U. S. Geol. Surv. Bull. 106. 288 pp.

GEOLOGY, INVERTEBRATE

Description of fossil invertebrates of the Colorado Formation during the Cretaceous period.

801. Starostka, V., B. Nielson, and R. Stone. 1973. Flaming Gorge Reservoir and Green River post-impoundment investigations; 1972-1973 annual performance report. Utah Div. Wildl. Resour., Salt Lake City, Publ. 74-11. 27 pp.

FISH, LIMNOLOGY, MANAGEMENT, RESERVOIR, RIVER-Green, SURVEY

Survey of the limnology and fishery of the Flaming Gorge Reservoir and the Green River in 1973.

802. Starostka, V., and R. Stone. 1972. Flaming Gorge Reservoir and Green River investigations. Utah Div. Wildl. Resour., Salt Lake City, Prog. Rep. Proj. F-28-R. 14 pp.

FISH, LIMNOLOGY, MANAGEMENT, RIVER-Green, SURVEY

Survey of the limnology and fishery of the Green River and Flaming Gorge Reservoir in 1972.

803. Steele, T. D., D. P. Bauer, P. A. Wentz, and J. W. Warner. 1976. An environmental assessment of impacts of coal development on the water resources of the Yampa River basin, Colorado and Wyoming -- Phase I work plan. U. S. Geol. Surv., Denver, Colo., Open File Rep. 76-367. 17 pp.

ENERGY, MINERAL, RIVER-Yampa, WATER QUALITY, WATER QUANTITY

Describes the potential impacts of coal mining on the availability and quality of the Yampa River.

804. Steele, T. D., I. C. James II, and D. P. Bauer. 1976. An environmental assessment of impacts of coal development on the water resources of the Yampa River basin, Colorado and Wyoming--Phase II work plan. U. S. Geol. Surv., Denver, Colo. Open-file Report. 33 pp.

ECOLOGY, ENERGY, MINERAL, RIVER-Yampa, WATER RESOURCE

Describes the objectives for a 2.5-year program by the U. S. Geological Survey to assess the availability and quality of the water resources in the Yampa River basin. The potential impacts of mining and power companies on the river environment will also be evaluated.

805. Stegner, W., editor. 1955. This is Dinosaur. Alfred A. Knopf, New York. 97 pp.

DESCRIPTION, GEOLOGY, HISTORY, RIVER-Green, Yampa

Reviews the natural resources in Dinosaur National Monument. Supplemented with photographs (some in color) of the area.

806. Stein, M., chairman. 1972. Conference on the matter of pollution of the interstate waters of the Colorado River and its tributaries. Seventh session. U. S. Environ. Protect. Agency, Washington, D. C. 2 vols., 1142 pp. + appendices. (With Proceedings of Reconvened 7th Session, 178 pp.)

POLLUTION, RIVER-Colorado and tributaries, WATER QUALITY

Seventh conference on pollution of the interstate waters of the Colorado River and its tributaries, held under the provisions of Section 8 of the Federal Water Pollution Control Act. Conference was held between the official water pollution control agencies of the concerned states and the federal government. The first session was held in 1960 and proceedings were published for each year.

807. Stenger, F. 1953. References on irrigation economics in the West with special reference to federal reclamation projects. U. S. Bur. Reclam., Denver, Colo. 4 pp.

ECONOMICS, IRRIGATION, RECLAMATION

Brief bibliography of economics of federal reclamation projects as related to irrigation in western United States.

808. Stevens, J. C. 1938. The effect of silt removal and flow regulation on the regimen of the Rio Grande and Colorado Rivers. Trans. Am. Geophys. Union 1938 (Part 2): 653-659.

RIVER-Colorado, SEDIMENT, STREAMFLOW

Describes the effect of streamflow regulation and sediment removal on the regimen of the Colorado River.

809. Stockton, C. W., and G. C. Jacoby, Jr. 1976. Long-term surface-water supply and streamflow trends in the upper Colorado River Basin based on tree-ring analysis. Univ. Calif., Inst. Geophys. Lake Powell Res. Proj. Bull. 18. 70 pp.

PRECIPITATION, RIVER-Colorado, STREAMFLOW, VEGETATION

Growth rings of trees were used as a basis for estimating past precipitation and streamflow in the upper basin.

810. Stokes, W. L. 1964. Incised, wind-aligned stream patterns of the Colorado Plateau. Am. J. Sci. 262: 808-816.

CLIMATE, GEOLOGY, LIMNOLOGY

Description of physical features of aligned and incised streams, and their patterns in relation to present wind directions and sand sources on the Colorado Plateau.

811. Stone, J. L., and N. L. Rathbun. 1968. Glen Canyon Unit--Colorado River Storage Project; Reservoir fisheries investigations; creel census and plankton studies; February 1, 1967-January 31, 1968. Arizona Game Fish Dep., Phoenix. 56 pp.

FISH, MANAGEMENT, PLANKTON, RESERVOIR, RIVER-Colorado

Describes the blooms of plankton in Lake Powell and identifies 10 zooplankton and 20 zooplankton genera. Also provides creel census data on the sport fishery in the reservoir.

812. Stone, J. L., and N. L. Rathbun. 1969. Glen Canyon Unit--Colorado River Storage Project; Lake Powell fisheries investigations; creel census and plankton studies; February 1, 1968-January 31, 1969. Arizona Game and Fish Dep., Phoenix. 60 pp.

FISH, MANAGEMENT, PLANKTON, RESERVOIR, RIVER-Colorado

Summarizes the occurrence of 15 zooplankton and 21 phytoplankton genera collected in Lake Powell, and the distribution of fishing pressure and success rate of the sport fishery as determined by a creel census.

813. Stone, R., L. Fields, and K. Miller. 1965. Lake Powell post-impoundment investigations. Utah State Dep. Fish Game, Salt Lake City, Prog. Rep. 2. 39 pp.

FISH, LIFE HISTORY, LIMNOLOGY, MANAGEMENT, RESERVOIR, RIVER-Colorado, SURVEY

Describes a survey of the limnology and fishery of Lake Powell in 1964-65.

814. Stone, R., and K. Miller. 1966. Glen Canyon Reservoir post-impoundment investigation. Utah State Dep. Fish Game, Salt Lake City, Prog. Rep. 3. 56 pp.

FISH, LIFE HISTORY, LIMNOLOGY, MANAGEMENT, RESERVOIR, RIVER-Colorado, SURVEY

Describes a survey of the limnology and fishery of the Glen Canyon Reservoir in 1966.

815. Stone, R., and K. Miller. 1967. Glen Canyon Reservoir post-impoundment investigation. Utah State Div. Fish Game, Salt Lake City, Prog. Rep. 4. 105 pp. + appendix.

FISH, LIFE HISTORY, LIMNOLOGY, MANAGEMENT, RESERVOIR, RIVER-Colorado, SURVEY

Describes a survey of the limnology and fishery of the Glen Canyon Reservoir in 1967.

816. Stone, R., K. Miller, J. K. Summers, C. Thompson, and A. F. Regenthal. 1968. Glen Canyon Reservoir post-impoundment investigation. Utah State Div. Fish Game, Salt Lake City, Prog. Rep. 5. 124 pp.

FISH, HISTORY, LIFE HISTORY, LIMNOLOGY, MANAGEMENT, RESERVOIR, RIVER-Colorado, SURVEY

Describes a survey of the limnology and fishery of the Glen Canyon Reservoir in 1968.

817. Stratton, O., and P. Sviotkin. 1959. The Echo Park controversy. Univ. of Alabama Press, University, Ala. 100 pp.

HISTORY

Discussion over the controversy of whether or not to build a dam at Echo Park in Dinosaur National Monument.

818. Stroud, R. H. 1963. Green River humpbacks. Sport Fish. Inst. Bull. 141: 7.

FISH-rare, HABITAT, RESERVOIR, RIVER-Green, Yampa

Description of the alterations of the niche of the Green River humpback chub caused by the construction of the Flaming Gorge Reservoir. Various factors regarding the status of this fish are reviewed.

819. Subcommittees on Hydrology and Sedimentation, Inter-Agency Committee on Water Resources. 1964. Annotated bibliography on hydrology and sedimentation, 1959-1962 (United States and Canada). Joint Hydrol.-Sediment. Bull. 8. 335 pp.

HYDROLOGY, SEDIMENT

Contains 4,000 references on all aspects of hydrology and sedimentation published in the United States and Canada from 1959 to 1962.

820. Sumison, C. T. 1971. Geology and water resources of the Spanish Valley area, Grand and San Juan Counties, Utah. Utah Dep. Nat. Resour. Tech. Publ. 32. 45 pp.

CLIMATE, GEOLOGY, PRECIPITATION, RIVER-Colorado, WATER QUANTITY

The Spanish Valley area covers an area of 144 square miles on the western slopes of the La Sal Mountains in southeastern Utah. Inflow to this area is 115,000 acre-feet annually from precipitation, and about 28,000 acre-feet are discharged annually by surface streams and the groundwater reservoir; the remainder is lost through evaporation. Describes the precipitation, climate, topography, and geology.

821. Sumison, C. T. 1971. Water resources investigations in Dinosaur National Monument, fiscal year 1970. U. S. Geological Survey and U. S. National Park Service, Open-file Report, Salt Lake City, 52 pp.

GROUNDWATER, RIVER-Green, WATER QUALITY, WATER QUANTITY

Summarizes the water resources available at Dinosaur National Monument to provide drinking water to visitors.

822. Sumison, C. T. 1976. Developing a state water plan; groundwater conditions in Utah spring of 1976. U. S. Geol. Surv., Coop. Invest. Rep. 15, Salt Lake City, Utah. 69 pp.

GROUNDWATER, PLAN

This is the 13th report of a series that describes goundwater conditions in Utah. Contains information on well construction, groundwater withdrawals, water-level changes, and related changes in precipitation and streamflow.

823. Sumison, C. T., and Bolke, E. L. 1972. Water resources of part of Canyonlands National Park, southeastern Utah. U. S. Geol. Surv. Open-File Rep., Salt Lake City, Utah. Prepared for U. S. Natl. Park Serv. 75 pp. + maps.

GROUNDWATER, RIVER-Colorado, Green, WATER QUALITY, WATER QUANTITY

Discusses the water supplies available at Canyonlands National Park for use by visitors.

824. Suttkus, R. D., and G. H. Clemmer. 1977. The humpback chub, Gila cypha, in the Grand Canyon area of the Colorado River. Tulane Univ. Mus. Nat. Hist. La., Occas. Pap. No. 1. 30 pp.

FISH-rare, LIFE HISTORY, RIVER-Colorado

The humpback chub, Gila cypha, is redefined from specimens (24.6-320 mm TL) collected from the Colorado River in the Grand Canyon. Notes are presented on growth and development, sexual dimorphism, breeding tubercles and coloration, and reproduction as well as standard meristic and morphometric data.

825. Sutton, R. J. 1976. The humpback chub. Colo. Outdoors 25(4): 20-21.

DISTRIBUTION, FISH-rare, RIVER-Colorado

A popular account of latest authentic record of Gila cypha from the Colorado River near the Colorado-Utah border. This species was found in deep water with a slow current, in apparent contradiction to the hypothesis that the shape of this minnow represents an adaptation for life in torrential waters.

826. Swanson, G. A., technical coordinator. 1979. The mitigation symposium: a national workshop on mitigating losses of fish and wildlife habitats. U. S. Forest Serv., Gen. Tech. Rep. RM-65. 696 pp.

FISH, HABITAT, LAW, MANAGEMENT, WILDLIFE

This compilation contains 133 papers on inland wetlands, economic considerations, mining, oil, and gas, planning, evaluation and inventory, surveys, power projects, terrestrial management, aquatic management, legal and political considerations, transportation systems, and state perspectives that pertain to the mitigation of losses of fish and wildlife habitats.

827. Symons, J. M., S. R. Weibel, and G. G. Robeck. 1964. Influence of impoundments on water quality: a review of literature and statement of research needs. U. S. Dep. Health, Educ., Welfare, Public Health Serv. Publ. 999-WP-18. 78 pp.

RESERVOIR, STREAMFLOW, WATER QUALITY

Literature review of the influence of impoundment releases on downstream water quality and discussion of major research needs on reservoirs.

828. Taba, S. S., J. R. Murphy, and H. H. Frost. 1965. Notes on the fishes of the Colorado River near Moab, Utah. Proc. Utah Acad. Sci. Arts Lett. 42(II): 280-283.

ABUNDANCE, DISTRIBUTION, FISH, FOOD HABITS, RIVER-Colorado

Summary of fish collected from the Colorado River from Moab, Utah, downstream 25 miles to Dead Horse Point--May 1962 and October 1964.

829. Talsma, T., and J. R. Philip, editors. Salinity and water use. National Symposium on Hydrology, Australian Acad. Sci., 2-4 November 1971. MacMillan, Melbourne. 296 pp.

ECONOMICS, GROUNDWATER, HYDROLOGY, SALINITY, WATER QUALITY

Collection of papers discussing problems of salinity in surface waters and groundwaters.

830. Tanner, V. M. 1936. A study of the fishes of Utah. Proc. Utah Acad. Sci. Arts Lett. 13: 155-183.

DESCRIPTION, DISTRIBUTION, FISH

Key to fishes of Utah. Includes distribution of native fishes and history of introduced species.

831. Terrell, J. U. 1965. War for the Colorado River: above Lee's Ferry. Vol. 2. The Arthur H. Clark Co., Glendale, Calif. 323 pp.

HISTORY, LAW, POLICY

Describes the politics involved in the Colorado River Storage Project.

832. Tester, J. R. 1953. Waterfowl production in Brown's Park, Colorado. M. S. Thesis, Colorado State Univ., Fort Collins. 98 pp.

RIVER-Green, WILDLIFE

Study of waterfowl produced in Brown's Park on the Green River.

833. Tew, R. K. 1973. Estimating soil erosion losses from Utah watersheds. U. S. Forest Serv., Intermount. Region, Ogden, Utah. 11 pp.

EROSION, RUNOFF, SEDIMENT, SOIL, WATER QUALITY

Techniques for estimating soil erosion in Utah, including parts of the Colorado Riever Basin.

834. Thomas, H. E. 1951. The conservation of groundwater: a survey of the present groundwater situation in the United States. McGraw-Hill Book Co., Inc., New York. 327 pp.

GROUNDWATER, MANAGEMENT, STREAMFLOW

Description of the history and effect of groundwater use. Reviews hydrologic principles and describes problems associated with reservoirs, pipelines, and watercourses.

835. Thomas, H. E. 1952. Hydrologic reconnaissance of the Green River in Utah and Colorado. U. S. Geol. Surv. Circ. 129. 32 pp.

HYDROLOGY, PRECIPITATION, STREAMFLOW, RIVER-Green

Information obtained during a boat reconnaissance trip in September 1948, and from steam-gauging stations on the Green River and many of its tributaries. Provides data on water quantity and quality, surface-water and groundwater inflow, surface outflow, loss by evapotranspiration, and relation of streamflow to regional geology and groundwater hydrology. Recommendations are made for further hydrologic studies.

836. Thomas, H. E. 1962. Water and the Southwest--what is the future? U. S. Geol. Surv. Circ. 469. 15 pp.

PRECIPITATION, STREAMFLOW, WATER RESOURCE, WATER QUANTITY

Discussion of water supply as related to problems and opportunities, controversies, development, water rights, etc.

837. Thomas, H. E. 1963. Effects of drought in the Colorado River Basin. U. S. Geol. Surv. Prof. Pap. 372-F. 51 pp.

PRECIPITATION, RIVER-Colorado, STREAMFLOW

Describes the effects of the prolonged drought of 1942-56 on the basin; the lower basin was mainly affected and the drought did not affect the upper basin (the chief water-producing area) until 1953. The main effects were depletion of water storage and increase in salinity. However, areas served by the Colorado River usually had adequate water supplies, despite local deficiencies in precipitation.

838. Thomas, H. E. 1970. Water laws and concepts. U. S. Geol. Surv. Circ. 629. 18 pp.

LAW, POLICY

Discussion of the water laws of the United States, with examples of disputes about water rights and other litigation.

839. Thomas, N. O., and G. E. Harbeck, Jr. 1956. Reservoirs in the United States. U. S. Geol. Surv. Water Supply Pap. 1360-A. 99 pp. + map.

RESERVOIR, RIVER-Colorado and tributaries

Descriptive data for 1,300 reservoirs, with a capacity of 5,000 acre-feet or more, and for natural lakes having a usable capacity of 5,000 acre-feet or more. Provides data on reservoirs completed or under construction by 1 January 1954. Includes reservoirs on the Colorado River.

840. Thomas, W. P., G. T. Blanch, O. W. Israelsen, D. F. Petersen, and D. S. Jennings. 1949. Colorado River and Utah's agriculture: preliminary report. Utah State Agric. Coll., Utah Agric. Exp. Stn. Spec. Rep. 1. 33 pp. + map.

AGRICULTURE, IRRIGATION, RIVER-Colorado, WATER RESOURCE

Concerns the importance of water obtained from the Colorado River Basin to the increased growth of agriculture in Utah.

841. Thompson, R. J. 1968. Effect of grazing on infiltration in a western watershed. J. Soil Water Conserv. 23(2): 63-65.

EROSION, GRAZING, RIVER-Colorado, SOIL

Provides information on infiltration rates and soil erosion as related to grazing in Badger Wash, near Grand Junction, Colorado.

842. Thorne, D. W. 1974. The development and environmental protection of the Colorado River Basin. Pages 298-313 in A. B. Crafword and D. F. Peterson, eds. Environmental management of the Colorado River Basin. Utah State Univ., Logan.

ECOLOGY, MANAGEMENT, PLAN, RECLAMATION, RIVER-Colorado

Preliminary assessment of our knowledge and research needs for the upper basin.

843. Thorne, J. P., and D. W. Thorne. 1951. Irrigation waters of Utah: their quality and use. Utah State Univ., Utah Agric. Exp. Stn. Bull. 346. 64 pp.

ALLOCATION, IRRIGATION, MANAGEMENT, MINERAL, SALINITY, SURVEY, WATER QUALITY

Periodic samples collected from most of the irrigation streams of Utah in 1949-50 were analyzed for total salt, electrical conductivity, calcium, magnesium, potassium, sodium chloride, sulfate, bicarbonate, carbonate, nitrate, and boron. Recommendations are made for irrigation, soil management practices, and crop selection where waters of low quality must be used.

844. Timmons, J. F., and D. Kirkham. 1972. Soil science in relation to water management: Part 5--economic evaluation of water resources data. Proc. Soil Sci. Soc. Am. 39(1): 187-194.

ECONOMICS, MANAGEMENT, VEGETATION, WATER QUANTITY

Reviews the policy on water allocation in relation to soil science, flood control, and economics in the decision-making process of water resource development.

845. Tippetts, H. J. 1975. Recreation uses of boating waters in Utah. Utah Dep. Nat. Resour., Salt Lake City. 33 pp.

RECREATION, WATER RESOURCE

Summarizes the recreational boating in Utah waters.

846. Tippy, R. 1968. Preservation values in river basin planning. Nat. Resour. J. 8(2): 259-278.

MANAGEMENT, PLAN, RECREATION, WATER QUANTITY

Recommends that river basin planning include consideration of fish, wildlife, and recreation, as well as other aspects.

847. Tipton and Kalmback Inc., 1965. Water supplies of the Colorado River available for use by the states of the Upper Division and for use from the main stem by the states of Arizona, California, and Nevada in the Lower Basin. Report prepared for the Upper Colorado River Commission. 24 pp + tables and appendix.

MANAGEMENT, RECLAMATION, RIVER-Colorado and tributaries, WATER QUALITY

Determines the amount of water available for use by states of the lower basin after water is supplied to the states of the upper basin. Contains detailed river and reservoir operation studies and estimated depletions from the river by the states of the Upper Colorado River Basin, with a discussion of future demand.

848. Todd, D. K. 1970. The water encyclopedia. Water information Center, Port Washington, N. Y. 559 pp.

CLIMATE, HYDROLOGY, PLAN, WATER RESOURCE

Compendium of useful general information and factual data on water resources. Compilation of data from many sources is presented in tabular form. The text consists only of explanatory notes and footnotes by chapter, including (1) climate and precipitation, (2) hydrologic elements, (3) surface water, (4) ground water, (5) water use, (6) water quality and pollution control, (7) water resources management, (8) agencies and organizations, and (9) constant and conversion factors.

849. Tomlinson, B. R. 1955. Water requirements of native mountain meadows in the Green River Basin of Wyoming. M. S. Thesis, Univ. Wyoming, Laramie. 81 pp.

IRRIGATION, MANAGEMENT, RIVER-Green

Attempts to determine optimum irrigation water requirements for the production of native hay and forage on the meadowlands of the Green River Basin in Wyoming. Also discusses current water use practices and effective methods of water management in relation to the use of fertilizers.

850. Toney, D. P. 1974. Observations on the propagation and rearing of two endangered fish species in a hatchery environment. Proc. Annu. Conf. West. Assoc. State Game Fish Comm. 54: 252-259.

FISH, MANAGEMENT

Describes efforts to spawn and propagate Colorado squawfish and humpback suckers from wild fish under hatchery conditions.

851. Torres, J., S. Bissell, G. Craig, W. Graul, and D. Langlois. 1978. Essential habitat for threatened or endangered wildlife in Colorado. Colorado Div. Wildl., Denver. 87 pp.

ABUNDANCE, DISTRIBUTION, FISH-rare, HABITAT, RIVER-Colorado, Dolores, Green, Gunnison, San Juan, White, Yampa, WILDLIFE

List of endangered and threatened fish and wildlife in Colorado, causes of decline, maps delineating historical and present range within the state, and a description of critical habitat.

852. Torres, J., S. Bissell, G. Craig, W. Graul, and D. Langlois. 1978. Wildlife in danger: the status of Colorado's threatened or endangered birds, fish and mammals. Colorado Div. Wildl., Denver. 31 pp.

ABUNDANCE, FISH-rare, RIVER-Colorado

Popular overview of threatened or endangered species in Colorado. Provides a brief account of the biology of each species and reason(s) for their numbers. Also explains the rationale in saving endangered species, how species become classified as threatened and endangered, and Colorado's program to restore such wildlife species. The fish species from the Colorado River drainage that are covered in this booklet include the Colorado River cutthroat trout, Colorado squawfish, razorback sucker, humpback chub, and bonytail chub.

853. Townsend, J. E., and R. J. Smith, editors. 1977. Improving fish and wildlife benefits in range management. U. S. Fish Wildl. Serv., Off. Biol. Serv., FWS/OBS-77/1. 118 pp.

FISH, GRAZING, MANAGEMENT, WILDLIFE

Proceedings of a symposium on ways to improve or maintain fish and wildlife habitat in range management. The benefits that were identified during this symposium could be achieved in the upper Colorado River basin.

854. Tsivoglov, E. C. 1964. A study of water quality conditions in the Animas-San Juan-La Plata area--summer, 1961. U. S. Dep. Health, Educ. and Welfare, Public Health Serv., Robert A. Taft Sanitary Eng. Center, Cincinnati, Ohio. 114 pp.

ABUNDANCE, DESCRIPTION, FISH, HYDROLOGY, INVERTEBRATE, LIMNOLOGY, PLANKTON, RIVER-San Juan and tributaries, SURVEY

Intensive field survey of the Animas, La Platte, and San Juan Rivers, 17 July-4 September 1961, on water quality conditions. Some information was collected on plankton and bottom fauna but no fish collections were made. Information on sport fish was obtained from the Colorado Game and Fish Department.

855. Tsivoglov, E. C., S. D. Shearer, J. D. Jones, C. E. Sponagle, H. R. Pahren, J. B. Anderson, and D. A. Clark. 1960. Survey of the interstate pollution of the Animas River (Colorado-New Mexico) II. 1959 surveys. U. S. Dep. Health, Educ. Welfare, Public Health Serv., Robert A. Taft Eng. Center, Cincinnati, Ohio. 53 pp.

ABUNDANCE, FISH, HYDROLOGY, INVERTEBRATE, LIMNOLOGY, RIVER-San Juan tributary, SURVEY

Survey of Animas River in 1959 that supplements a 1958 survey. The Vanadium Corporation of America took measures to abate pollution beginning in June 1959. Provides short-term before-and-after information on this abatement measure. River algae responded quickly, yielding 17-30% of the gross alpha radioactivity found before the abatement. The number of invertebrate species increased after the abatement, but the abundance and weight did not improve greatly.

856. Tsivoglov, E. C., S. D. Shearer, R. M. Shaw, J. D. Jones, J. B. Anderson, C. E. Sponagle, and D. A. Clark. 1959. Survey of interstate pollution of the Animas River, Colorado-New Mexico. U. S. Dep. Health, Educ., Welfare Public Health Serv., Robert A. Taft Eng. Center, Cincinnati, Ohio. 116 pp.

ABUNDANCE, FISH, HYDROLOGY, INVERTEBRATE, LIMNOLOGY, PLANKTON, RIVER-San Juan tributary, SURVEY

Survey of the Animas River during the summer of 1958. Includes a wide variety of environmental factors such as river water, muds and biota, treated water supplies, food grown locally with irrigation water from the Animas River, locally produced milk, precipitation, and effluents from the uranium ore refinery.

857. Turner, D. J. 1971. Dams and ecology: can they be made compatible? Civ. Eng. 41(8): 76-80.

ECOLOGY, RECLAMATION, RESOURCE, WATER QUANTITY

Discusses aesthetics, conservation, and legal aspects of water resource development with reference to dams.

858. Turner, G. T. 1971. Soil and grazing influences on a salt-desert shrub range in western Colorado. J. Range Manage. 24(1): 31-37.

GRAZING, SOIL, VEGETATION

Exclusion of livestock for 10 years from a range was studied in Badger Wash, 25 miles northwest of Grand Junction, Colorado. Runoff would enter the Colorado River drainage. No major differences were found between grazed and ungrazed land. However, grazing combined with drought resulted in deterioration of cover, and soil characteristics were also important.

859. Turney, J. R., and H. H. Ellis. 1962. State water-rights laws and related subjects, a bibliography. U. S. Dep. Agric. Misc. Publ. 921. 199 pp.

BIBLIOGRAPHY, LAW, POLICY

Bibliography to 1959 covering publications on state water-rights laws, including law reviews.

860. Udis, B., editor. 1967. An analysis of the economy of the upper main stem subbasin of the Colorado River Drainage Basin in 1960 with emphasis on the heavy water-using industries. Univ. Colorado, Boulder. Rep. to U. S. Fed. Water Pollut. Control Admin., Contract WA 67-4. 220 pp.
Gila River Subbasin Rep. 256 pp.
Green River Subbasin Rep. 395 pp.
San Juan River Subbasin Rep. 203 pp.

AGRICULTURE, ECONOMICS, GRAZING, MINERAL, MODEL, RIVER-Colorado, Green, San Juan
WATER QUANTITY

Detailed economic analysis and model of the heavy water-using industries of the Upper Colorado River in 1960. Separate reports for the Green and San Juan Rivers.

861. Udis, B., editor. 1968. An interindustry analysis of the Colorado River Basin in 1960, with projections to 1980 and 2010. Univ. Colorado, Boulder. (Final Rep. to U. S. Fed. Water Control. Admin., Contract WA 67-4.) 249 pp. + appendix I - 377 pp.; and appendix II - 139 pp.

AGRICULTURE, DESCRIPTION, ECONOMICS, GRAZING, MINERAL, MODEL, RIVER-Colorado, Green, San Juan, WATER QUANTITY

Final report of a detailed economic analysis and model of the heavy water-using industries of the upper Colorado River in 1960, with projections to 1980 and 2010.

862. Udis, B., C. W. Howe, and J. F. Kreider. 1973. The interrelationship of economic development and environmental quality in the Upper Colorado River Basin: an interindustry analysis. Univ. Colo. Dep. Econ. Res. Rep., and Natl. Tech. Inf. Serv., Springfield, Va., Com-73-11970/3. 651 pp.

ECONOMICS, HYDROLOGY, MODEL, PLAN, POLLUTION, RIVER-Colorado, Green, San Juan, SALINITY
WATER QUALITY

A set of compatible models relating the economic activities of the subbasins of the Upper Colorado River, both present and prospective, to air quality and water quantity and quality resulting from economic development. The report describes in detail the models which have been developed for the three upper subbasins (the Upper Main Stem, the Green, and the San Juan). This area has some of the most pressing problems of the basin, such as high salinity and the oil shale industry as well as increased diversion of water to the eastern slopes of the Rocky Mountains.

863. Untermann, G. E., and B. R. Untermann. 1969. Popular guide to the geology of Dinosaur National Monument. Dinosaur Nature Association, Dinosaur National Monument, Utah-Colorado. 135 pp.

ARCHAEOLOGY, GEOLOGY, HISTORY, RIVER-Green, Yampa

Guide to the geology of Dinosaur National Monument, with a brief section on geography and history.

864. Upper Colorado River Basin Compact. 1948. Upper Colorado River Basin Compact. (Entered into by the states of Arizona, Colorado, New Mexico, Utah, and Wyoming.) Santa Fe., 28 pp.

LAW, POLICY, RIVER-Colorado

The official compact as entered into by the states indicated on the apportionment of water from the Colorado River.

865. Upper Colorado River Commission. 1974. Official record. Upper Colo. River Comm., Salt Lake City, Utah. Vol. 26. 302 pp.

ECONOMICS, LAW, POLICY, RIVER-Colorado and tributaries

The Commission was established by the Upper Colorado River Basin Compact in 1948, with responsibility for adopting rules and legislation, forecasting water runoff, determining reservoir losses and apportionment, as well as other matters relating to the management of the Upper Colorado River. Official records published since 1948.

866. Upper Colorado River Commission. 1975. Annual report of the Upper Colorado River Commission. Salt Lake City, Utah. 111 pp. (Annual reports since 1947.)

HYDROLOGY, LAW, MANAGEMENT, RECLAMATION, RIVER-Colorado and tributaries, SALINITY, STREAMFLOW

The Upper Colorado River Basin Compact requires the Commission to submit an annual report. This report includes engineering and hydrologic data, pertinent legal information, and Congressional legislation, maps, and status of storage units of the Colorado River Storage Project.

867. Upper Colorado River Commission. 1975. Selected legal references. Volume III. Upper Colorado River Commission. Salt Lake City, Utah. 608 pp.

LAW, POLICY, RIVER-Colorado and tributaries

Contains all acts and laws (state and federal) enacted since 1971 pertaining to the Upper Colorado River Basin. The two earlier volumes (1961 and 1971) are also available.

868. U. S. Bureau of Land Management. Various dates. Management framework plan. U. S. Bur. Land Manage. District Office, Colo., N.M., Wyoming, and Utah. Various pagination.

MANAGEMENT, PLAN, RESOURCES

A comprehensive plan prepared by each BLM district for the management of the resources within the district. Plans are in looseleaf form and contain overlay maps of the various resources to be managed. The framework plans are periodically reviewed and updated.

869. U. S. Bureau of Land Management. 1973. Modification of oil shale withdrawal in Colorado, Utah, Wyoming: sale of oil leases. U. S. Bur. Land Manage., Washington, D. C. 13 pp.

MINERAL, POLICY, RESOURCES

Brief summary of oil shale leases on Bureau of Land Management land.

870. U. S. Bureau of Land Management. 1974. Livestock grazing management on national resource lands. Final environmental impact statement, U. S. Bur. Land Manage., Washington, D. C. Two supplements. Various pagination.

FISH, GRAZING, MANAGEMENT, WATER RESOURCE, WILDLIFE

Reviews the environmental impacts of livestock grazing on fish, wildlife, water resources, etc. on national resource lands managed by the Bureau of Land Management.

871. U. S. Bureau of Land Management. 1976. Environmental impact statement-Northwest Colorado coal. U. S. Bur. Land Manage., Washington, D. C. Various pagination.

Volume 1. Regional Analysis.
Volume 2. Ruby Construction Company - Peabody Coal Company - Mine and reclamation plans.
Volume 3. W. R. Grace and Company - Mine and reclamation plans.
Volume 4. W. R. Grace and Company - Railroad plans.
Volume 5. Energy Fuels Corporation - Mine and reclamation plans.

Appendix A. Maps.
Appendix B. Map foldouts.
Appendix C. Glossary and bibliography.
Appendix D. Other support material.

FISH, MANAGEMENT, MINERAL, WATER RESOURCE, WILDLIFE

Review of the environmental impacts on fish, wildlife, water resources, etc., from the development of coal in northwestern Colorado. Development of these mineral resources would have an impact on the Yampa and Green Rivers.

872. U. S. Bureau of Land Management et al. 1972. The Green River: Flaming Gorge Dam to the Colorado River - a prelude for action. U. S. Bur. Land Manage., Bur. Outdoor Rec., Bur. Reclam., Bur. Sport Fish. Wildl., Colo. Dep. Nat. Resour., Natl. Park Serv., Forest Serv., and Utah Dep. Nat. Resour., Denver, Colorado, and Salt Lake City, Utah. 21 pp.

MANAGEMENT, POLICY, RIVER-Green

A recommendation by all of the federal and state agencies listed as authors to protect and manage a valuable resource in the West--the Green River.

873. U. S. Bureau of Reclamation. 1946. The Colorado River, a natural menace becomes a natural resource. U. S. Bur. Reclam., Washington, D. C. 293 pp. + 9 maps.

AGRICULTURE, ECONOMICS, RESOURCES, RIVER-Colorado, WATER QUANTITY

Comprehensive report on the development of the water resources of the Colorado River Basin for irrigation, power production, and other beneficial uses in Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming.

874. U. S. Bureau of Reclamation. 1950. Colorado River Storage Project and participating projects; Upper Colorado River Basin. Project Planning Report No. 4-8a. 81-1. U. S. Bur. Reclam., Salt Lake City, Utah. Various pagination.

ALTERATION, POLICY, RECLAMATION, RIVER-Colorado and tributaries

Description of the projects proposed for the Upper Basin with recommendations on the priority of each project. Lists projected costs and gives simplified diagrams for the dams and other related details.

875. U. S. Bureau of Reclamation. 1951. Central Utah Project, Utah. U. S. Bur. Reclam., Salt Lake City, Utah. Proj. Planning Rep. 4-8a. 50-2.

Summary Rep. with:
Appendix A. Designs and estimates. 287 pp.
Appendix B. Water supply. 186 pp.
Appendix C. Power. 66 pp.
Appendix D. Agriculture. 133 pp.
Appendix E. Municipal and industrial water, flood control. 54 pp.
Appendix F. Financial analysis. 48 pp.

AGRICULTURE, ECONOMICS, IRRIGATION, POWER, RECLAMATION, RIVER-Green, WATER QUALITY, WATER QUANTITY

Reviews various aspects of the Central Utah Project by the Bureau of Reclamation that would involve the interbasin transfer of water from the Uinta Mountains of Utah through the Wasatch Mountains to the Great Basin drainage.

876. U. S. Bureau of Reclamation. 1960. Studies of ground-water movement. U. S. Bur. Reclam., Denver, Colo. Tech. Memo. 657. 180 pp.

GROUNDWATER

Summarizes information pertaining to the movement of groundwater.

877. U. S. Bureau of Reclamation. 1963. Juniper Project, Colorado and Utah--reconnaissance report. U. S. Bur. Reclam., Salt Lake City, Utah. 91 pp.

RIVER-Yampa, SURVEY, WATER RESOURCE

Survey of the feasibility and water resources as related to the Juniper Project.

878. U. S. Bureau of Reclamation. 1963. Special studies--delivery of water to Mexico. U. S. Bur. Reclam., Boulder City, Nev. 108 pp.

MANAGEMENT, RIVER-Colorado, SALINITY

A comprehensive report on engineering studies of methods for alleviating the salinity problem of the Lower Colorado River that is in accord with the 1944 Water Treaty with Mexico.

879. U. S. Bureau of Reclamation. 1964. Price and San Pitch River Basins, Utah. U. S. Bur. Reclam., Salt Lake City, Utah. Basin Report. 71 pp.

RIVER-Price, SURVEY, WATER QUANTITY

Survey of the water supply in the Price River.

880. U. S. Bureau of Reclamation. 1966. Potential water resource developments in the Upper Colorado River Basin in Utah. U. S. Bur. Reclam., Salt Lake City. 34 pp.

HYDROLOGY, RIVER-Green, Price, San Juan, SURVEY, WATER QUANTITY

Maps, water profiles, hydrology, and water uses for various water development projects, including units of the Central Utah Project, Juniper, Gray Canyon, San Juan County, and Price River.

881. U. S. Bureau of Reclamation. 1969. San Juan investigation--Utah and Colorado. U. S. Bur. Reclam., Salt Lake City, Utah. 184 pp.

AGRICULTURE, MINERAL, RECLAMATION, RECREATION, RESOURCES, RIVER-Colorado, Dirty Devil, Dolores, WATER QUANTITY

Comprehensive study of possibilities for water resource developments within San Juan County, Utah, as well as adjacent areas in Grand County, Utah, and Dolores, San Miguel, Montrose, and Mesa Counties, Colorado, that are southwest of the Dolores River. Lists 20 potential water resource developments and discusses the potential population size of the area as related to the economics of agriculture, mining, and recreation.

882. U. S. Bureau of Reclamation. 1971. Thesaurus of water resources terms. U.S. Bur. Reclam., Washington, D. C. 339 pp.

DESCRIPTION, WATER RESOURCE

Collection of terms related to water resources for use in indexing technical information.

883. U. S. Bureau of Reclamation. 1972. Alternative plans for water resource developments: Green River Basin, Wyoming. U. S. Bur. Reclam., Salt Lake City, Utah. Spec. Rep. 95 pp.

RIVER-Green, SURVEY

Survey of resources, needs, and alternative plans for development in the Green River in Wyoming.

884. U. S. Bureau of Reclamation. 1972. Federal reclamation and related laws--annotated, Volumes I-III. U. S. Bur. Reclam., Washington, D. C. 2211 pp.

LAW, POLICY

Chronological compilation of public statutes of the United States relating to the activities of the Bureau of Reclamation, in the development and use of water for irrigation and related purposes. An earlier version was published as: U. S. Bureau of Reclamation. 1958. Federal reclamation laws-annotated. U. S. Bur. Reclam., Washington, D. C. 766 pp.

885. U. S. Bureau of Reclamation. 1972. A joint research proposal on the prediction of mineral quality of return flow water from irrigated land. U. S. Fed. Water Pollut. Control. Adm., Bur. Reclam., Denver, Colo. 44 pp. + 6 appendices.

Appendix I.	Vernal Unit, Utah. 10 pp.
Appendix II.	Moncos Project. 6 pp.
Appendix III.	Hammond Project. 13 pp.
Appendix IV.	Grand Valley Project Orchard Mesa Division. 6 pp.
Appendix V.	Oahe Unit, Missouri River Basin Project. 10 pp.
Appendix VI.	Computer Simulation Lompoc Basin, California. 36 pp.

IRRIGATION, MINERAL, RIVER-Colorado, Green, WATER QUALITY

Proposal that describes research for prediction of water quality from irrigation return flows.

886. U. S. Bureau of Reclamation. 1973. Central Utah Project, Bonneville Unit, Final Environmental Statement. U. S. Bur. Reclam. 865 pp. + appendix A-Review comments. 579 pp.

ALTERATION, DESCRIPTION, ECOLOGY, ECONOMICS, FISHERY, GEOLOGY, INVERTEBRATE, IRRIGATION, LAW, POLICY, RECLAMATION, RECREATION, RESERVOIR, SALINITY, SEDIMENT, SNOWPACK, STREAMFLOW, SURVEY, VEGETATION, WATER QUALITY, WATER QUANTITY

The final environmental impact statement on the Bonneville Unit of the Central Utah Project. It is a thorough description of the proposal, the environment, the impact of the proposal, and alternatives to the proposal. Other environmental impact statements have been prepared for the Jensen, Vernal, Uintah, Upalco, and Ute Indian units of the Central Utah Project.

887. U. S. Bureau of Reclamation. 1974. Alternative sources of water for prototype oil shale development - Colorado and Utah, U. S. Bur. Reclam., Upper Colorado Region, Salt Lake City, Utah. 114 pp.

LAW, MINERAL, RESOURCES, RIVER-Green, White, STREAMFLOW, WATER QUANTITY

Identifies specific alternative sources of water for use in prototype oil shale development in west central Colorado and east central Utah. Discusses existing reservoirs and proposed projects and the feasibility of using these reservoirs as a source of water for oil shale development.

888. U. S. Bureau of Reclamation. 1974. Report on water for energy in the Upper Colorado River Basin. U. S. Bur. Reclam., Water for Energy Management Team, Denver, Colo. 71 pp.

ENERGY, RIVER-Colorado, WATER QUANTITY

A review of water supply that is available for energy development in the upper Colorado River.

889. U. S. Bureau of Reclamation. 1974. Statistical compilation of diversion dams on Bureau of Reclamation projects. U. S. Bur. Reclam., Washington, D. C. 29 pp.

DAM, IRRIGATION, RECLAMATION, RESERVOIR

Information on Bureau of Reclamation diversion dams, including capacity, height, crest length, volume, calendar year completed, and footnotes.

890. U. S. Bureau of Reclamation. 1974. Statistical compilation of storage dams, dikes, and reservoirs on Bureau of Reclamation projects. U. S. Bur. Reclam., Washington, D. C. 62 pp.

DAM, IRRIGATION, RECLAMATION, RESERVOIR

Information on Bureau of Reclamation projects, including, for storage dams and dikes, the capacity, height, crest length, volume, and calendar year completed, with footnotes; and for reservoirs, purpose, capacity, surface area, and year completed, with footnotes.

891. U. S. Bureau of Reclamation. 1975. Colorado River Storage Project and participating projects; 18th annual report - FY 1974. U. S. Bur. Reclam., Salt Lake City, Utah. 36 pp.

RECLAMATION, RESERVOIR, RIVER-Colorado

Annual report on storage and participating projects on the Colorado River. Reports available since 1956.

892. U. S. Bureau of Reclamation. 1975. Environmental assessment of proposed Penstock intake modifications, Flaming Gorge Dam, Utah. U. S. Bur. Reclam., Upper Colorado Region. Salt Lake City, Utah. 50 pp.

ECOLOGY, FISH, FISH-rare, INVERTEBRATE, LIMNOLOGY, MANAGEMENT, PLANKTON, RIVER-Green, TEMPERATURE, WATER QUANTITY

An evaluation of the environmental impacts of proposed penstock modifications for intakes from levels near the reservoir surface. Discusses the effects of existing penstock levels and dam profile, and proposed changes; describes environment, reservoir operation, water quality, water fluctuations, thermal stratification, fish, plankton, aquatic invertebrates, terrestrial wildlife, recreation, streamflows, and vegetation. Includes species lists, graphs, and a map.

893. U. S. Bureau of Reclamation. 1975. Quality of water: Colorado River Basin. U. S. Bur. Reclam., Washington, D. C., Prog. Rep. 7. 195 pp.

RIVER-Colorado, WATER QUALITY

The latest biennial report of a continuing study began in 1962 on the water quality of the Colorado River basin.

894. U. S. Bureau of Reclamation. 1975. Review of maintenance--examination of condition of irrigation structures and facilities, 1975, Bureau of Reclamation, Upper Colorado Region. U. S. Bur. Reclam., Salt Lake City, Utah. 211 pp.

DAM, IRRIGATION, RECLAMATION, RESERVOIR

General description of irrigation structures and facilities (water surface area, water in storage, etc.) emphasizing existing conditions and recommendations for improvement.

895. U. S. Bureau of Reclamation. 1975. Salinity and sediment study: Upper Colorado River Basin - Utah, Colorado, and Wyoming. U. S. Bur. Reclam., Salt Lake City, Utah. 80 pp.

RIVER-Colorado and tributaries, SALINITY, SEDIMENT

Identifies the salinity characteristics and sediment yield in the Upper Colorado River Basin.

896. U. S. Bureau of Reclamation. 1976. Colorado River water quality improvement program, environmental statement. U. S. Bur. Reclam., Salt Lake City, Utah. 571 pp.

ECONOMICS, RIVER-Colorado, SALINITY, WATER QUALITY

Discusses plans for reducing salt load of the Colorado River.

897. U. S. Bureau of Reclamation. 1976. Colorado River System consumptive uses and losses, 1971-75. U. S. Dep. Inter., Bur. Reclam., Upper Colorado Region, Salt Lake City, Utah. 65 pp.

DESCRIPTION, MANAGEMENT, RIVER-Colorado, WATER QUANTITY

Estimates the consumptive uses and losses of water from the Colorado River System by year between 1971 and 1975, pursuant to Article VI, P. L. 90-537, the Colorado River Basin Project Act. Summarizes the major types of water use by state for this river system.

898. U. S. Bureau of Reclamation. 1976. Colorado River water quality improvement program, environmental statement. U. S. Bur. Reclam., Salt Lake City, Utah. 571 pp.

ECONOMICS, RIVER-Colorado, SALINITY, WATER QUALITY

Discusses plans for reducing salt load of the Colorado River.

899. U. S. Bureau of Reclamation. 1976. Savery-Pot Hook Project Colorado and Wyoming. Draft Environmental Statement. U. S. Bur. Reclam., Upper Colorado Region, Salt Lake City, Utah. 215 pp.

ALLOCATION, ALTERATION, DAM, RECLAMATION, RESERVOIR, RIVER-Little Snake, WATER RESOURCE

Describes the environment of the Little Snake River and its tributaries along the Colorado-Wyoming state line and water resource development of the proposed Savery-Pot Hook Project in the Upper Colorado River Basin by the Bureau of Reclamation. Provides information on the environmental impacts of this development.

900. U. S. Bureau of Reclamation. 1977. Colorado River system-Consumptive uses and losses, 1971-1975. U. S. Bur. Reclam., Salt Lake City. 73 pp.

RECLAMATION, RIVER-Colorado, STREAMFLOW, WATER RESOURCE

Summarizes current and projected consumptive uses and losses of water from the Colorado River system.

901. U. S. Bureau of Reclamation and U. S. Soil Conservation Service. 1977. Final environmental statement-Colorado River water quality improvement program. U. S. Bur. Reclam., Upper Colorado Region, Salt Lake City. 2 Vol.

AGRICULTURE, IRRIGATION, MANAGEMENT, RECLAMATION, RESOURCE, RIVER-Colorado, Dirty Devil, Dolores, Duchesne, Green, Gunnison, Price, San Juan, San Rafael, White, SALINITY, STREAMFLOW, WATER QUALITY, WATER RESOURCE

Environmental statement summarizing the environmental impacts of 14 salinity control projects in Nevada, California, Utah, Colorado, Arizona, and Wyoming. Three types of salinity control projects were considered: point source, irrigation source, and diffuse source. Four salinity control projects have been authorized by Congress: Paradox Valley Unit, Colorado; Grand Valley Unit, Colorado; Crystal Geyser Unit, Utah; and Las Vegas Wash Unit, Nevada. Management plan to reduce the salinity of the Colorado River at Imperial Dam by about 150 mg/l. The four initial units will provide an initial reduction of 43 mg/l. On an annual basis, the estimated reductions amount to 1,589,000 and 460,000 tons of salt removed from the river system for full program implementation and the initial control units, respectively.

902. U. S. Corps of Engineers. 1975. Colorado Water Resources Development. U. S. Army, Corps Eng., Missouri River Div., Omaha, Nebraska. 54 pp.

ALTERATION, FLOOD, IRRIGATION, LAW, POWER, RECREATION, RIVER-Colorado and tributaries, WATER QUANTITY

Concerns the water resources development program of the Corps of Engineers in Colorado, including flood control, navigation, hydroelectric power, water supply, recreation, etc. Briefly describes the function of the Corps of Engineers and active proposed projects in each Colorado basin.

903. U. S. Department of Agriculture, Field Advisory Committee. 1957. Paonia Project, Colorado. Colorado River Storage Project: A report of reappraisal of direct agricultural benefits and project impacts. U. S. Dep. Agric., Salt Lake City, Utah. 68 pp. + maps.

AGRICULTURE, RIVER-Colorado and tributaries, WATERSHED

An appraisal of the agricultural benefits of Paonia Project plus a statement of its impacts on national forests and the relation of watershed condition to the project. One of a series of reports; others are Emery County Project, Utah, 1961, 76 pp. + maps; Smith Fort Project, Colorado, 1958, 69 pp. + maps; Florida Project, Colorado, 1959, 68 pp.

904. U. S. Department of Health, Education, and Welfare. 1963. Protection of domestic water supplies and studies of pollutional parameters during the Green River Fish Control Project. U. S. Publ. Health Serv., Region VIII, Denver, Colo. PR-14. 62 pp.

ALTERATION, FISH, FISHERY, MANAGEMENT, RESERVOIR, RIVER-Green, WATER QUALITY

Activated carbon removed toxicity, taste, and odor from the treated river water to a satisfactory degree for domestic use. No major significant effect of these characteristics could be attributed to the toxicant operation. Benthic invertebrates were reduced drastically throughout the treated area. Little change was noted in phytoplankton, but the zooplankton was practically eliminated.

905. U. S. Department of Health, Education, and Welfare. 1963. Water resources study and public health aspects of the Central Utah Project--Bonneville Unit, Utah. U. S. Publ. Health Serv., Denver, Colo. and U. S. Bur. Reclam., Salt Lake City, Utah. 58 pp. + appendices A. B.

DESCRIPTION, ECONOMICS, STREAMFLOW, WATER QUALITY

Reviews the potential impacts of water quality and streamflow from project construction and operations on water quality. Information was provided on the Duchesne River, a tributary of the Green River.

906. U. S. Department of Health, Education, and Welfare. 1966. Disposition and control of uranium mill tailings piles in the Colorado River Basin. U. S. Fed. Water Pollut. Control Admin., Region VIII, Denver, Colo. 36 pp. + 28 pp. appendix.

MINERAL, RIVER-Colorado, WATER QUALITY

Reviews radioactive contamination of the Colorado River from uranium mill tailings and provides an estimated cost to control this pollution.

907. U. S. Department of the Interior. 1968. Man...an endangered species? U. S. Dep. Inter., Conserv. Yearb. 4. 100 pp.

ECOLOGY, MANAGEMENT, POPULATION

Emphasizes that overpopulation and unbridled technology--both self-induced by man--is threatening man's environment and himself. Points out that proper development and control of pollution will be needed for the management of water resources. Stresses the importance of the Colorado River in the Pacific Southwest.

908. U. S. Department of the Interior. 1970. River of life--water: the environmental challenge. U. S. Dep. Inter., Conserv. Yearb. 6. 96 pp.

ECOLOGY, MANAGEMENT, WATER QUANTITY

Summarizes the importance of water in man's activities; points out the abuse of man on his water resources, and directs the U.S. population to clean up pollution and use water resources intelligently.

909. U. S. Department of the Interior. 1971. Our living land. U. S. Dep. Inter., Conserv. Yearb. 7. 96 pp.

ECOLOGY, MANAGEMENT, RESOURCES

Concisely emphasizes that environmental quality will not be achieved cheaply or easily. Recommends land planning as a solution to proper and wise use of our lands.

910. U. S. Department of the Interior. 1972. Southwest energy study: an evaluation of coal-fired electric power generation of the Southwest. U. S. Dep. Inter., Southwest Energy Study Management Team, Washington, D. C.

Summary Rep. 141 pp.
Appendix A. Power development and economic effects. 202 pp.
Appendix B. Water supply. 46 pp.
Appendix C. Air and water pollution. 174 pp.
Appendix D. Water resources monitoring. 106 pp. + maps, tables.
Appendix E. Meteorology. 113 pp. + 63 figures.
Appendix F. Land use. 209 pp.
Appendix G. Indians. 111 pp. + attachments.
Appendix H. Biota. 182 pp. + attachments.
Appendix I. Recreation and aesthetics. 128 pp.
Appendix J. Coal resources. 72 pp. + appendices.
Appendix K. Mining. 94 pp.

ARCHAEOLOGY, ECOLOGY, ENERGY, FISH, MANAGEMENT, MINERAL, POLICY, RIVER-Colorado, WATER QUANTITY

Comprehensive review of developing electric power on the Colorado River basin that provides suggestions for alternative uses of the water.

911. U. S. Department of the Interior. 1972. With us on earth. Pages 70-77 in Indivisible one. U. S. Dep. Inter., Conserv. Yearb. 8.

DISTRIBUTION, FISH-rare, HABITAT

Discusses the extinction of animals in the United States and the role of animals as part of this biological heritage to the people of the United States.

912. U. S. Department of the Interior. 1973. Final environmental statement for the prototype oil shale leasing program. U. S. Dep. Inter., Washington, D. C. Six vol. Various pagination.

Vol. I. Regional impacts of oil shale development.
Vol. II. Energy alternatives.
Vol. III. Specific impacts of prototype oil shale development.
Vol. IV. Consultation and coordination with others.
Vol. V. Letters received during review process.
Vol. VI. Public hearings held during the review process.

DISTRIBUTION, ECONOMICS, MINERAL, WATER QUALITY, WATER QUANTITY

Comprehensive statement on the development of oil shale in Colorado, Utah, and Wyoming covering various aspects of the region, people, and natural resources.

913. U. S. Department of the Interior. 1973. Threatened wildlife of the United States. U. S. Bur. Sport Fish. Wildl. Resour. Publ. 114 (Revision of Resour. Publ. 34). 289 pp.

FISH-rare, LAW, MANAGEMENT, POLICY

An official list of endangered wildlife in the United States, including fish found in the Colorado River.

914. U. S. Department of the Interior. 1974. Report on water for energy in the Upper Colorado River Basin. U. S. Dep. Inter., Water for Energy Management Team, Denver, Colo. 71 pp.

ENERGY, POLICY, RIVER-Colorado and tributaries, WATER QUANTITY

Summary of water supply that is available for energy development in the upper Colorado River basin. The water of this basin is over-appropriated and the supply for development of energy and other uses will not be sufficient to meet the demand to the year 2000 without proper management.

915. U. S. Department of the Interior, National Park Service. 1946. A survey of the recreational resources of the Colorado River Basin. U. S. Natl. Park Serv., Washington, D. C. 242 pp.

RECREATION, RESOURCES, RIVER-Colorado, SURVEY

Survey of the recreational potential of the Colorado River. Describes the climate, geology, spectacular natural features, vegetation, wildlife, and other aspects of areas administered by the National Park Service.

916. U. S. Department of the Interior, National Park Service. 1963. Report of the Green River Ecology Studies Conference, September 4, 1963. U. S. Natl. Park Serv., Dinosaur National Monument. Artesia, Colorado. Approximately 40 pp.

DISTRIBUTION, FISH, INVERTEBRATE, RIVER-Green, Yampa

Minutes of a meeting of research on the Green River in Dinosaur National Monument. Includes information on fish collected from the Green River in 1962 and provides a list of threatened or endangered fish species found in the United States.

917. U. S. Department of the Interior, National Park Service. 1975. Proposed Dinosaur National Monument Wilderness. Final environmental impact statement, U. S. Natl. Park Serv., Dinosaur National Monument. NPS 523. 163 pp.

MANAGEMENT, RECREATION, RIVER-Green, Yampa

Environmental impact statement for a proposed wilderness area in Dinosaur National Monument.

918. U. S. Department of State. 1972. Flow of the Colorado River and other western boundary streams and related data. Int. Boundary Water Comm., United States and Mexico. West. Water Bull. 98 pp.

RIVER-Colorado, STREAMFLOW, WATER QUALITY

Summarizes annual information on the quantity and quality of water, climatological data, and irrigated areas for the Colorado River. Annual summaries are available since 1959.

919. U. S. Department of State. 1973. Possible options for reducing the salinity of the Colorado River waters flowing to Mexico. Final environmental impact statement, U.S. Dep. State, Washington, D. C., and Natl. Tech. Inf. Serv., Springfield, Va. EIS-NM-73-1516-F. 329 pp.

IRRIGATION, RECLAMATION, RESOURCES, RIVER-Colorado, SALINITY, WATER QUALITY, WEATHER

Summarizes the anticipated environmental effects and provides recommendations on how the U. S. might reduce the salinity of the Colorado River waters being delivered to Mexico. The alternatives considered in the impact statement include nine desalting projects, relining a part of the Coachella Canal, adapting improved irrigation techniques to save water, closing the Wellton-Mohawk District to remove or reduce the flows now contributing to salinity of the Colorado River waters, and weather modification techniques to augment the water resources in the Colorado Basin.

920. U. S. Environmental Protection Agency. 1970. Water quality conditions in Grand Lake, Shadow Mountain Lake, and Lake Granby. U. S. Environ. Protect. Agency, Water Qual. Office, Pacific Southwest Region, San Francisco, Calif. 62 pp.

POLLUTION, SURVEY, WATER QUALITY

Preliminary survey of water quality in three high mountain lakes in the headwaters of the Colorado River.

921. U. S. Environmental Protection Agency. 1971. The mineral quality problem in the Colorado River. U. S. Environ. Protect. Agency, Regions VIII and IX. Denver, Colorado.

Summary Rep.	65 pp.
Appendix A.	Natural and man-made conditions affecting mineral quality. 168 pp.
Appendix B.	Physical and economic impacts. 166 pp.
Appendix C.	Salinity control and management aspects. 135 pp.
Appendix D.	Comments on draft reports. 73 pp.

ECONOMICS, LIMNOLOGY, MANAGEMENT, MINERAL, MODEL, RIVER-Colorado, SALINITY, WATER QUALITY, WATER QUANTITY

Discusses various aspects of water quality in the Colorado River and the many ramifications caused by the increasing mineral load. Includes intensive, short-term water quality field investigations, long-term water quality monitoring, mathematical simulation of water quality relationships, reconnaissance level evaluation of specific salinity control measures, and detailed economic studies.

922. U. S. Environmental Protection Agency. 1972. Effects of pesticides in water: a report to the states. U. S. Environ. Protect. Agency, Washington, D. C. 145 pp.

POLLUTION, WATER QUALITY

Summary of the latest scientific knowledge available indicating the kind and extent of effects on health and welfare which may be expected from the presence of pesticides in the water in varying quantities. Provides summary tables of pesticides and their effects on aquatic organisms.

923. U. S. Environmental Protection Agency. 1972. Evaluation of the Wyoming water supply program. U. S. Environ. Protect. Agency, Region VIII. Water Supply Branch, Air Water Progr. Div., Denver, Colo. 236 pp.

LAW, POLICY, WATER QUALITY

Review of Wyoming's program for maintaining water quality. Bacteriological and chemical qualities of the supplies were judged on the basis of the 1962 U. S. Public Health Service Drinking Water Standards. In addition, the adequacy of the water supply program was evaluated on the basis of surveillance activities, laboratory resources, policies, legislation, budget, and manpower.

924. U. S. Environmental Protection Agency. 1973. Radium-226, uranium, and other radiological data from water quality surveillance stations located in the Colorado River Basin of Colorado, Utah, New Mexico, and Arizona--January, 1961 through June, 1972. U. S. Environ. Protect. Agency, Region VIII, Denver, Colo. 8SA/TIB-24. 67 pp. + 155 pp. appendix.

POLLUTION, RIVER-Colorado, SURVEY, WATER QUALITY

Survey of radioactivity at selected stations on the Colorado River, 1961-72.

925. U. S. Environmental Protection Agency. 1974. Evaluation of the Colorado water supply program. U. S. Environ. Protect. Agency, Region VIII, Water Supply Sect., Water Div., Denver, Colo. 144 pp.

LAW, POLICY, WATER QUALITY

Public water supplies maintained by the Colorado Department of Health are extensively reviewed. Bacteriological and chemical qualities of the supplies are judged on the basis of the 1962 U. S. Public Health Service Drinking Water Standards. In addition, the adequacy of the water supply program is evaluated in regard to its legislative authority, regulations, policies, surveillance activities, laboratory support, manpower, and budget.

926. U. S. Fish and Wildlife Service. 1950. Substantiating report for a special report on recreational use and water requirements of the Colorado River fishery below Granby Dam in relation to the Colorado-Big Thompson diversion project. U. S. Fish Wildl. Serv., Office of River Basin Studies, Albuquerque, N.M. 150 pp.

FISHERY, RESERVOIR, RIVER-Colorado, STREAMFLOW

Provides recommendations for streamflows necessary to preserve the recreational fishery between Granby Dam on the Colorado River downstream to the confluence with the Fraser River.

927. U. S. Fish and Wildlife Service. 1969. The right to exist. U. S. Fish Wildl. Serv. Resour. Publ. 69. 12 pp.

DISTRIBUTION, FISH-rare, HABITAT

Covers the impact of alterations on fish and wildlife habitat and populations with numerous examples from fish, reptiles, mammals, and birds.

928. U. S. Fish and Wildlife Service. 1974. United States list of endangered fauna. U. S. Dep. Inter. Bull. 22 pp.

FISH-rare, LAW, MANAGEMENT, POLICY

Basically an official list of endangered fauna (fish, reptiles, birds, and mammals) as recognized by the United States. Provides some general information on prohibited acts and restrictions, as well as permits.

929. U. S. Fish and Wildlife Service. 1976. Savery-Pot Hook Project - Colorado and Wyoming. U. S. Dep. Inter., Fish Wildl. Serv., Denver, Colo. 39 pp. + 5 plates.

DESCRIPTION, FISH, FISH-rare, RECLAMATION, RESOURCES, RIVER-Yampa tributary, WILDLIFE

Reviews the impacts of the Savery-Pot Hook Project by the Bureau of Reclamation on the fish and wildlife resources of the Little Snake River, a tributary to the Yampa River.

930. U. S. Fish and Wildlife Service. 1978. Colorado squawfish restoration plan approved by Service. U. S. Fish Wildl. Serv., Endangered Species Tech. Bull. 3(4): 3.

FISH-rare, MANAGEMENT, PLAN, RIVER-Colorado

Describes the unique adaptation of the Colorado squawfish to Colorado River environment and major steps of the recovery plan that has been approved by the U. S. Fish and Wildlife Service.

931. U. S. Fish and Wildlife Service. 1979. Wanted for the future - these native fishes of the Colorado River. U. S. Dep. Inter., Fish Wildl. Serv., Washington, D. C., through U.S. Gov. Print. Off. 1979-678-636. 5 pp.

FISH-rare, RIVER-Colorado

Brochure with descriptions of the Colorado squawfish, humpback chub, bonytail chub, and razorback sucker with the main purpose of informing the public about these rare fish so that they will not be killed accidentally by anglers.

932. U. S. Geological Survey. 1917. Profile surveys in the Colorado River Basin in Wyoming, Utah, Colorado, and New Mexico. U. S. Geol. Surv. Water-Supply Pap. 396. 6 pp. + 43 maps.

RIVER-Colorado, SURVEY

Series of plan and profile maps of the Upper Colorado River Basin.

933. U. S. Geological Survey. 1948. Mineral resources of the United States. U. S. Geol. Surv. Public Affairs Press, Washington, D. C. 212 pp.

MINERAL, RESOURCES

Summarizes the mineral resources of the United States. Individual mineral coverage includes metallurgical, refractory, and chemical grades and reserves by location and state. Includes many minerals found in the Upper Colorado River Basin of Utah, Colorado, and Wyoming.

934. U. S. Geological Survey. 1956. Inventory of published and unpublished chemical analyses of surface waters in western United States, 1947-1955. U. S. Geol. Surv., Notes on Hydrolog. Act. Bull. 9. 114 pp.

BIBLIOGRAPHY, SURVEY, WATER QUALITY

An inventory of reports containing information on water quality for surface water in western United States.

935. U. S. Geological Survey. 1961-present. Water resources data for Colorado. Part 1. Surface water records. U. S. Geol. Surv., Denver, Colo. Various pagination.

RIVER-Colorado, Green, Yampa and tributaries, STREAMFLOW

Annual streamflow data for Colorado. Before 1961, records were published annually in water supply papers "Surface water supply of the United States." Between 1951 and 1960, 20 volumes were published under Parts 6B, 7, 8, and 9 of that series.

936. U. S. Geological Survey. 1966-present. Water resource data for Colorado. Part 2. Water quality records. U. S. Geol. Surv., Denver, Colo. Various pagination.

RIVER-Colorado, Green, Yampa and tributaries, SEDIMENT, TEMPERATURE, WATER QUALITY

Annual water quality data for Colorado. From 1941 to 1963, these data were published annually as water supply papers "Quality of surface waters of the United States" as Parts 5-6, 7-8, and 9-10 of that series, with information on chemistry, temperature, and sediments.

937. U. S. Geological Survey. 1961-present. Water resources data for New Mexico. Part 1. Surface water records. U. S. Geol. Surv., Albuquerque, N. M. Various pagination.

RIVER-San Juan, STREAMFLOW

Annual streamflow data for New Mexico. Before 1961 records were published annually in water supply papers, "Surface water supply of the United States." Between 1951 and 1960, 20 volumes were published under Parts 7, 8, and 9 of that series.

938. U. S. Geological Survey. 1966-present. Water resources data for New Mexico. Part 2. Water quality records. U. S. Geol. Surv., Albuquerque, N. M. Various pagination.

RIVER-San Juan, SEDIMENT, TEMPERATURE, WATER QUALITY

Annual water quality data for New Mexico. In 1941-65, these data were published in an annual series of water supply papers "Quality of surface waters of the United States," containing information on chemical quality, temperature, and suspended sediment.

939. U. S. Geological Survey. 1961-present. Water resources data for Utah, Part 1. Surface water records of Utah. U. S. Geol. Surv., Water Resour. Div., Salt Lake City, Utah. Various pagination.

RIVER-Colorado and tributaries, STREAMFLOW, WATER QUANTITY

Annual summaries of water supply for Utah, including streamflows of the Colorado River and its tributaries.

940. U. S. Geological Survey. 1964-present. Water resources data for Utah. Part 2. Water quality records. U. S. Geol. Surv., Water Resour. Div., Salt Lake City, Utah. Various pagination.

RIVER-Colorado and tributaries, SEDIMENT, TEMPERATURE, WATER QUALITY

Annual summaries of water quality data for Utah waters, including the Colorado River and tributaries.

941. U. S. Geological Survey. 1961-present. Water resources data for Wyoming. Part 1. Water supply records. U. S. Geol. Surv., Water Resour. Div., Worland, Wyo. Various pagination.

RIVER-Green and tributaries, Little Snake, WATER QUANTITY

Provides annual flow records for the Green River and its tributaries. Data for some stations may be incomplete for some years, or may not be continuous.

942. U. S. Geological Survey. 1961-present. Water resources data for Wyoming. Part 2. Water quality records. U. S. Geol. Surv., Water Resour. Div., Worland, Wyo. Various pagination.

RIVER-Green and tributaries, Little Snake, WATER QUALITY

Provides annual water quality records for the Green River and its tributaries. Data for some stations may be incomplete for some years, or may not be continuous.

943. U. S. Geological Survey. 1964. Compilation of records of surface waters of the United States, October 1950 to September 1960-Part 9, Colorado River Basin. U. S. Geol. Surv. Water-Supply Pap. 1733. 586 pp.

RESERVOIR, RIVER-Colorado and tributaries, STREAMFLOW

Report of a series presenting monthly and yearly summaries of streamflow and reservoir data collected by the Geological Survey.

944. U. S. Geological Survey. 1964. Mineral and water resources of Utah. U. S. Geol. Surv., Washington, D. C. 275 pp.

GEOLOGY, MINERAL, RESOURCES, WATER QUANTITY

Summarizes the mineral and water resources of Utah (many of which are in the Colorado Basin) by describing their distribution and relative importance to Utah and the United States, as well as the outlook for their development and use. Production figures are given for the various minerals, and economic factors that affect their exploration and development are discussed.

945. U. S. Geological Survey. 1965. Publications of geological survey 1879-1961. U. S. Geol. Surv., Washington, D. C. 457 pp.

BIBLIOGRAPHY, GEOLOGY, MINERAL, RIVER-Colorado and tributaries, WATER QUALITY, WATER QUANTITY

Provides a listing, by type, of U.S. Geological Survey publications to 1961 that includes various references on the Colorado River basin.

946. U. S. Geological Survey. 1966. Inventory of federal sources of ground-water data. U. S. Geol. Surv., Notes Hydrolog. Act. Bull. 12. 294 pp.

BIBLIOGRAPHY, GROUNDWATER, SURVEY

An inventory of sources for groundwater data available from federal agencies.

947. U. S. Geological Survey. 1969. Mineral and water resources of Utah. Report of the U. S. Geol. Surv. in cooperation with Utah Geol. and Mineral Surv. and Utah Water and Power Board, for Committee on Interior and Insular Affairs. 88th Congress, 2nd Session. 275 pp.

ECONOMICS, MINERAL, RESOURCES, WATER QUANTITY

Summarizes the mineral and water resources of Utah by describing their manner of occurrence, distribution, and relative importance to Utah and the United States, with an outlook for future development.

948. U. S. Geological Survey. 1969. The Colorado River region and John Wesley Powell. U. S. Geol. Surv. Prof. Pap. 669. 145 pp.

GEOLOGY, HISTORY, RIVER-Colorado

Collection of papers honoring Powell on the 100th anniversary of his exploration of the Colorado River, 1869-1969. Discusses Powell's contributions to the knowledge concerning the Colorado as well as more recent information concerning the geology of the area particularly in the Grand Canyon.

949. U. S. Geological Survey. 1971. Index of surface-water records to September 20, 1970-Part 9. Colorado River basin. U. S. Geol. Surv. Water Supply Circ. 659. 53 pp.

RESERVOIR, RIVER-Colorado, STREAMFLOW, WATER QUALITY

Lists streamflow and reservoir stations in the basin for which records have been or are to be published in Geological Survey reports through 20 September 1970. Provides the periods of record by station with the drainage area of each basin in square miles.

950. U. S. Geological Survey. 1974. John Wesley Powell's exploration of the Colorado River. U. S. Geological Survey Inf. Leaflet INF-74-19. 29 pp.

DESCRIPTION, HISTORY, RIVER-Colorado

Provides excerpts from Powell's written accounts as well as concise description of the region with historical information.

951. U. S. Geological Survey. 1975. River basins of the United States: The Colorado. U. S. Geological Survey Inf. Leaflet INF-72-8 (R 2). 7 pp.

DAM, RIVER-Colorado

Provides a concise summary of the Colorado River including a map that shows the locations of the major dams.

952. U. S. Geological Survey. 1976. Quality of surface waters of the United States, 1970: Parts 9 and 10, Colorado River Basin and The Great Basin. U. S. Geol. Surv. Water Supply Pap. 2158. 371 pp.

IRRIGATION, RIVER-Colorado and tributaries, WATER QUALITY

The records of chemical analyses, other physical measurements, and discharge given in this report constitute an annual compilation of data for 72 irrigation network stations in operation west of the Mississippi. This survey has been published annually, 1926-76.

953. U. S. 90th Congress. 1968. Colorado River Basin Project Act-Public Law 90-537, September 1968. U. S. 90th Congress, Washington, D. C. 16 pp.

ALTERATION, LAW, RIVER-Colorado

A federal act authorizing the construction, operation, and maintenance of the Colorado River Basin Project.

954. U. S. 93rd Congress. 1973. Endangered species act of 1973-Public Law 93-205. U. S. Senate and House of Representatives, 93rd Congress, Public Law 93-205. 28 December 1973. 21 pp.

FISH-rare, LAW, MANAGEMENT, POLICY

Federal law that declares policy of the U. S. Congress that all federal agencies shall conserve endangered and threatened species of fish, wildlife, and plants and shall use their authorities in furtherance of the purposes of this Act.

955. U. S. 93rd Congress. 1975. Wild and Scenic Rivers Act as amended through Public Law 93-621 (3 January 1975). U. S. Congress, Washington, D. C. 14 pp.

AESTHETICS, LAW, STREAMFLOW, WATER RESOURCE

A federal law for establishment of a national wild and scenic rivers system.

956. U. S. Public Health Service. 1951. Colorado River drainage basin - a cooperative state-federal report on water pollution. U. S. Public Health Serv., Fed. Secur. Agency Water Pollut. Ser. 9. 46 pp.

POLLUTION, RIVER-Colorado

Report by federal and state agencies summarizing water pollution in the Colorado River basin.

957. U. S. Public Health Service. 1958. Transcript of conference on interstate pollution of the Animas River, Colorado-New Mexico. U. S. Public Health Serv., Santa Fe, New Mexico. 64 pp.

POLLUTION, WATER QUALITY

Transcripts of a conference where diverse information related to pollution of the Animas River was summarized.

958. U. S. Public Health Service. 1961. A preliminary investigation of radioactivity in crops and soils on selected farms. U. S. Public Health Serv., Region VIII, Denver, Colo. 5 pp.

POLLUTION, SOIL, SURVEY, VEGETATION

Preliminary survey of radioactive pollution in crops and soils near Grand Junction, Colorado. Drainage would be into the Colorado River.

959. U. S. Public Health Service. 1961-62. Stream surveys in the vicinity of uranium mills. U. S. Public Health Serv., Region VIII, Denver, Colo.

I. 1961. Area of Grand Junction, Colorado--August 1960. 17 pp.
II. 1961. Area of Moab, Utah--August 1960. 18 pp.
III. 1961. Area of Uravan, Slick Rock, and Gateway, Colorado--August 1960. 31 pp.
IV. 1962. Area of Shiprock, New Mexico--November 1960. 20 pp. + appendix.

ABUNDANCE, DISTRIBUTION, HYDROLOGY, INVERTEBRATE, MINERAL, RIVER-Colorado, SURVEY, WATER QUALITY

Surveys of various areas on the Colorado and San Juan Rivers near uranium mills. Provides species and relative volumes of invertebrates. Also provides information on water quality and metal ions.

960. U. S. Public Health Service. 1962. A preliminary economic base study of the Animas-Laplatta Project watersheds in the four corners area of the Colorado River Basin. U. S. Public Health Serv., Region VIII, Denver, Colo. 245 pp.

ECONOMICS, RECLAMATION, RIVER-Colorado

Economic study of the Bureau of Reclamation project in the Animas and Laplatta Rivers.

961. U. S. Public Health Service. 1962. River mileage tabulations for the Colorado River Basin--communities and major tributaries. U. S. Public Health Serv., Region VIII, Denver, Colo. 19 pp.

DESCRIPTION, RIVER-Colorado, SURVEY

Summary of river mileage for major tributaries of the Colorado River Basin.

962. U. S. Public Health Service. 1962. State and county area tabulations for the Colorado River Basin. U. S. Public Health Serv., Region VIII, Denver, Colo. 16 pp.

DESCRIPTION, RIVER-Colorado, SURVEY, WATER RESOURCE

Summary of area within the Colorado River Basin by state and county.

963. U. S. Public Health Service. 1963. Annotated bibliography on the effects of irrigation practices on stream water quality with emphasis on salinity and pesticides. U. S. Publ. Health Serv., Region VIII, Denver, Colo. 37 pp.

BIBLIOGRAPHY, IRRIGATION, POLLUTION, RIVER-Colorado, SALINITY, WATER QUALITY

Bibliography with annotations concerning the effects of irrigation practices on water quality downstream. Contains information on salinity in the Colorado River basin.

964. U. S. Public Health Service. 1963. Land ownership in the Colorado River Basin. U. S. Public Health Serv., Region VIII, Denver, Colo. 15 pp.

DESCRIPTION, RESOURCES, RIVER-Colorado, SURVEY

Survey of land ownership of the Colorado River Basin.

965. U. S. Public Health Service. 1963. Physical and chemical stratification in two high altitude reservoirs of the Colorado River Basin. U. S. Public Health Serv., Region VIII, Denver, Colo. 41 pp.

LIMNOLOGY, RESERVOIR, RIVER-Colorado and tributaries

Study of basic limnology of Lake Granby at the headwaters of the Colorado River and Taylor Park Reservoir at the headwaters of the Gunnison River.

966. U. S. Public Health Service. 1963. Preliminary report on water quality and use aspects of the Price River basin in east Central Utah. U. S. Public Health Serv., Region VIII, Denver, Colo. 38 pp.

RIVER-Price, WATER QUALITY, WATER QUANTITY

A preliminary report on the water quality and supply of the Price River, a tributary to the Green River.

967. U. S. Public Health Service. 1963. The purpose and plan of an economic base survey of the Colorado River Basin. Colorado River Basin Water Quality Control Project, Rep. No. ER2, and Natl. Tech. Inf. Surv., Springfield, Va. PB-229 693/7. U. S. Public Health Serv., Region VIII, Denver, Colo. 21 pp.

ECONOMICS, POLLUTION, RIVER-Colorado, SURVEY

An analysis of the economic characteristics, developments, and trends of the past, and a projection of future economic growth on the basis of the area's basic available resources. The economic base survey in turn provides the basis for development of a water quality management program for the study area.

968. U. S. Public Health Service. 1963-65. Water resources study and public health aspects. U. S. Public Health Serv., Region VIII, Denver, Colo.

1963. Central Utah Project-Bonneville Unit. 58 pp. + appendix.
1963. Dallas Creek Project, Colorado. 62 pp.
1964. San Miguel Project, Colorado. 24 pp. + appendix.
1964. West Divide Project, Colorado. 29 pp. + appendix.
1965. Upalco Unit, Central Utah Project, Utah. 19 pp. + appendix.

RIVER-Colorado, Green, SURVEY, WATER QUALITY, WATER RESOURCE

Survey in 1963-65 of water resources of several Bureau of Reclamation projects on the Colorado and Green Rivers.

969. U. S. Public Health Service. 1964. Water quality control study and public health aspects of the West Divide Project, Colorado: study of potential needs and value of water for the purpose of water quality control and the public health aspects of the West Divide Project, Colorado. U. S. Public Health Serv., Region VIII, Denver, Colo., and Natl. Tech. Inf. Serv., Springfield, Va. PB-217 858. 44 pp.

RESERVOIR, RIVER-Colorado, WATER QUALITY, WATER RESOURCE

Assesses the probable effects of the proposed project on water quality in local streams and reservoirs. Ascertains the benefits of harm resulting from changes in water quality; assesses the suitability of the water for proposed water uses; and examines the need for regulation of streamflow for the purpose of water quality control.

970. U. S. Public Health Service. 1965. A study of municipal, rural, domestic and livestock water requirements in the Colorado River Basin. U. S. Public Health Serv., Region VIII, Denver, Colo. 40 pp.

RIVER-Colorado, SURVEY, WATER QUANTITY

Review of water supply and requirements for uses, including municipal, rural, domestic, and livestock.

971. U. S. Public Health Service. 1965. Colorado River Basin Water Quality Control Project. Colorado River Basin Water Quality Control Project, Progress Report. U. S. Public Health Serv., Denver, Colo., and Natl. Tech. Inf. Serv., Springfield, Va. PB-230 548/0. 93 pp.

POLLUTION, RIVER-Colorado, WATER QUALITY

The objectives of the Colorado River Basin Water Quality Control Project are (1) to determine the extent of pollution in the Colorado River Basin and its water service area in southern California; (2) to investigate principal sources of pollution in these areas and the contribution from these sources; (3) to determine the effects of pollution on various water uses; and (4) to prepare a plan, or plans, for improving water quality in the affected areas.

972. U. S. Public Health Service. 1965. Program review-Colorado River Basin Project. U. S. Public Health Serv., Region VIII, Denver, Colo. 72 pp. + appendix.

MANAGEMENT, RECLAMATION, RIVER-Colorado

Reviews water quality in relation to the Colorado River Basin Project.

973. U. S. Public Health Service. 1969. Evaluation of Radon 222 near uranium tailing pilings. U. S. Public Health Serv., DER 69-1. 67 pp.

MINERAL, POLLUTION, RIVER-Colorado, SURVEY, WATER QUALITY

Survey to evaluate the effects of Radon 222 near uranium tailings on the Colorado and Animas Rivers.

974. U. S. Public Health Service. 1970. Estimates of air pollution concentrations from four corners power plant, New Mexico. U. S. Public Health Serv., Region VIII, Denver, Colo. 109 pp. + appendix.

POLLUTION, POWER

Estimates air pollutants from power plant operation in the four corners area of Arizona, Colorado, New Mexico, and Utah.

975. U. S. Senate, 83rd Congress, Second Session. 1954. Colorado River Storage Project - Hearings before the Subcommittee on Irrigation and Reclamation of the Committee on Interior and Insular Affairs. U. S. Senate, 83rd Congress, 2nd Session on S.1555, Washington, D. C. 694 pp.

ALLOCATION, ALTERATION, LAW, POWER, RECLAMATION, RESERVOIR, RIVER-Colorado and tributaries, WATER QUANTITY

Senate hearings on the Colorado River Storage Project.

976. U. S. Soil Conservation Service. Various dates. Aerial photo coverage. U. S. Soil Conserv. Serv., Salt Lake City, Utah. Various pagination.

DESCRIPTION, RESOURCES, SURVEY

Coverage of various states by aerial photography.

977. U. S. Soil Conservation Service. Various dates. Soil survey by county and state. U. S. Soil Conserv. Serv., Washington, D. C. Various pagination.

AGRICULTURE, SOIL, SURVEY

Provides soil surveys in separate reports by county and state.

978. U. S. Soil Conservation Service. 1970. Irrigation water requirements. U. S. Soil Conserv. Serv., Tech. Release 21. 88 pp.

IRRIGATION

Covers the procedures used to estimate irrigation water requirements on a farm or on a project. Irrigation application efficiencies are discussed briefly. Gives procedures for measuring losses in existing farm distribution and project conveyance systems and for estimating losses in such systems.

979. U. S. Soil Conservation Service. 1975. On-farm salinity control investigations for the Grand Valley area, State of Colorado. U. S. Soil Conserv. Serv., Denver, Colo. 19 pp. + 3 attachments.

IRRIGATION, MANAGEMENT, SALINITY, WATER RESOURCE

Summary of salinity control measures in irrigated agriculture of the Grand Valley, Colorado.

980. U. S. Water Resources Council. 1968. The nation's water resources. U. S. Water Resour. Council, Washington, D. C.

Part 1. The nation's water and related land resources. 32 pp.
Part 2. Introduction. 5 pp.
Part 3. Water and related land resources. 38 pp.
Part 4. Water use. 47 pp.
Part 5. Management of water and related land. 60 pp.
Part 6. Regional water supplies and requirements. 185 pp.
Part 7. Appendices. 26 pp.

MANAGEMENT, RESOURCES, WATER QUALITY, WATER QUANTITY

Summarizes the supply and use of U. S. water resources, especially as related to land management.

981. Utah Cooperative Fishery Unit. 1967. Green River fishes and invertebrates. U. S. Fish Wildl. Serv., Utah Coop. Fish. Unit, Utah State Univ., Logan. Spec. Rep. 236 pp. (mimeo)

ABUNDANCE, AGE-GROWTH, DESCRIPTION, DISTRIBUTION, ECOLOGY, FISH, FISH-rare, FISHERY, INVERTEBRATE, LIFE HISTORY, MIGRATION, MOVEMENT, RIVER-Green, WATER QUALITY

Final report consisting of two theses from Utah State Univ. See Vanicek, C. D. 1967 (FISH) and Pearson, W. D. 1967 (INVERTEBRATE).

982. Utah Department of Natural Resources. 1971. Recreational uses of boating waters in Utah: laws and regulations governing boating, littering, pollution, swimming, scuba diving, and related activities. Utah Dep. Nat. Resour., Salt Lake City. 33 pp.

LAW, MANAGEMENT, RECREATION

Handbook of laws and regulations governing recreational use of boating waters in Utah.

983. Utah Department of Natural Resources. 1974. Inventory of water rights--Upper Colorado River Basin--Utah. Utah Dep. Nat. Resour., Salt Lake City. 163 pp.

LAW, RIVER-Colorado, SURVEY

Survey of the laws on water resources of the Upper Colorado River Basin in Utah.

984. Utah Division of Health. 1975. Colorado River Basin Complex water quality management plan (303e Plan). Utah Dep. Social Serv., Div. Health, Salt Lake City. 125 pp.

RIVER-Colorado, WATER QUALITY

Purpose of the 303(e) Basin Plan was to establish and coordinate activities related to water quality management on a river basin scale. Identified goals for establishing and maintaining water quality. Provided basin characteristics, populations, economics, and land use. Also identified point sources of pollution.

985. Utah Division of Parks and Recreation. 1973. River running in Utah; highlights of the current laws and regulations. Revised. Utah Dep. Nat. Resour., Div. Parks Recreation, Salt Lake City. 5 pp.

LAW, RECREATION, WATER RESOURCE

Summary of the regulations related to river running in Utah.

986. Utah Division of Water Resources. Various dates. River study unit. Utah Dep. Nat. Resour., Div. Water Resour., Hydrologic Inventory, Salt Lake City. Various pagination.

1970. Uintah Study Unit. 181 pp.
1975. Price River Study Unit. 63 pp.
1976. San Rafael River Study Unit. 87 pp.
(In preparation) Dirty Devil River Study Unit.
(In preparation) Escalante River Study Unit.

DESCRIPTION, ECONOMICS, GEOLOGY, HISTORY, RIVER-Dirty Devil, Escalante, Price, San Rafael

Includes climate and water resources data. Also includes information on physiography, economy, geology, and history.

987. Utah Division of Water Resources. 1963. Utah's water resources: problems and needs--a challenge. Utah Dep. Nat. Resour., Div. Water Resour., Salt Lake City. 122 pp.

MANAGEMENT, POLICY, WATER QUANTITY

This report reviews and evaluates the major problems, possibilities, and challenges relative to water resources in Utah. The deficiencies are not in the water supply but in the storage, transportation, treatment, and distribution of that supply. Proper planning and coordination of all water-related activities must be made to meet the water needs of Utah.

988. Utah Division of Water Resources. 1964. Laws of Utah as related to the Board of Water Resources and the Division of Water Resources. Utah Dep. Nat. Resour., Div. Water Resour., Salt Lake City. 28 pp.

LAW, WATER RESOURCE

Summary of laws as related to Utah water resources.

989. Utah Division of Water Resources. 1965. Water conservation agencies of the State of Utah. Utah Dep. Nat. Resour., Div. Water Resour., Water and Power Board, Salt Lake City. 115 pp.

LAW, MANAGEMENT, WATER RESOURCE

Describes the responsibilities of the various agencies in Utah concerned with the conservation of water resources.

990. Utah Division of Water Resources. 1967. Water resources law. Utah Dep. Nat. Resour., Div. Water Resour., Salt Lake City. 30 pp.

LAW, WATER RESOURCE

Summary of the Utah laws related to water resources.

991. Utah Division of Water Resources. 1973. Escalante River resource study-Task force I report. Utah Dep. Nat. Resour., Div. Water Resour., River Basin Study, Salt Lake City. 65 pp.

ECONOMICS, RIVER-Escalante, WATER RESOURCE

Inventory of the resources and their uses. Also contains information on economy, present and future needs, and developmental alternatives.

992. Utah Division of Water Resources. 1975. Fremont River study. Utah Dep. Nat. Resour., Div. Water Resour., Salt Lake City. 71 pp.

GEOLOGY, HYDROLOGY, RIVER-Dirty Devil, RUNOFF, TEMPERATURE, WATER QUALITY, WATER QUANTITY

Summarizes the water resource of the Fremont River - a tributary to the Dirty Devil River, Utah.

993. Utah Division of Water Resources. 1975. Hydrologic inventory of the Price River basin. Utah Dep. Nat. Resour., Div. Water Resour., Salt Lake City. 63 pp.

GEOLOGY, HYDROLOGY, RIVER-Price, RUNOFF, TEMPERATURE, WATER QUALITY, WATER QUANTITY

Summarizes the water resource of the Price River drainage in Utah.

994. Utah Division of Water Resources. 1976. Hydrologic inventory of the Escalante River Basin. Utah Dep. Nat. Resour., Div. Water Resour., Salt Lake City. 63 pp.

GEOLOGY, HYDROLOGY, RIVER-Escalante, RUNOFF, TEMPERATURE, WATER QUALITY, WATER QUANTITY

Summarizes the water resource of the Escalante River drainage, Utah.

995. Utah Division of Water Resources. 1976. Hydrologic inventory of the San Rafael River basin. Utah Dep. Nat. Resour., Div. Water Resour., Salt Lake City. 62 pp. + appendix.

GEOLOGY, HYDROLOGY, RIVER-San Rafael, RUNOFF, TEMPERATURE, WATER QUALITY, WATER QUANTITY

Summarizes the water resource of the San Rafael River drainage Utah.

996. Utah Division of Water Resources. 1976. The State of Utah water - 1975. Utah Dep. Nat. Resour., Div. Water Resour., Comprehensive Water Planning Program, Salt Lake City. 65 pp. + appendices A and B.

ALLOCATION, MANAGEMENT, POLICY, WATER RESOURCE

Status report on the state water planning effort including critical issues and policy recommendations by the Board of Water Resources.

997. Utah Division of Water Resources. 1977. Hydrologic inventory of the Dirty Devil study area. Utah Dep. Nat. Resour., Div. Water Resour., Salt Lake City. 91 pp.

GEOLOGY, HYDROLOGY, RIVER-Dirty Devil, RUNOFF, TEMPERATURE, WATER QUALITY, WATER QUANTITY

Summarizes the water resource of the Dirty Devil River in Utah.

998. Utah Division of Water Rights. Various dates. Proposed determination of water rights by river drainage. Utah Dep. Nat. Resour., Div. Water Rights, Salt Lake City. Various pagination.

LAW, MANAGEMENT, WATER QUANTITY

Summary of water rights that have been filed by river drainage through the Utah Department of Natural Resources, Division of Water Rights.

999. Utah Division of Water Rights-Division of Water Resources. 1974. Inventory of water rights-upper Colorado River basin, Utah. Utah Dep. Nat. Resour., Div. Water Rights and Water Resour., Salt Lake City, Utah. 169 pp.

ALLOCATION, LAW, WATER RESOURCE

An inventory of all water rights on record over one cubic foot per second in the Upper Colorado River Basin of Utah, including the rights created under state water law procedures, with an attempt to include decreed rights from actions between private parties. Reserved water rights of the Indians are not covered.

1000. Utah Division of Wildlife Resources. Various dates. Lakes of the High Uintas. Utah Dep. Nat. Resour., Div. Wildl. Resour., Salt Lake City. Six booklets, various pagination.

DESCRIPTION, FISH, SURVEY, WATER RESOURCE

A series of six booklets providing information on the names, locations, and sizes of lakes in the Uinta Mountains, Utah, and on the fish species present.

1001. Utah Division of Wildlife Resources. 1975. Studies for wildlife on energy areas. Utah Dep. Nat. Resour., Div. Wildl. Resour., Salt Lake City. 305 pp.

ENERGY, RESOURCE, WILDLIFE

Recommends studies to determine the impacts of energy development on wildlife.

1002. Utah Division of Wildlife Resources and Ecological Consultants, Inc. 1977. Annotated bibliography of natural resource information: southern Utah. U. S. Dep. Inter., Fish Wildl. Serv., Off. Biol. Serv., FWS/OBS-77/34. 246 pp.

BIBLIOGRAPHY, FISH, RESOURCES, WILDLIFE

Compilation of information on natural resources in southern Utah.

1003. Utah State Department of Fish and Game. 1959. The impact of Flaming Gorge Unit upon wildlife resources in northeastern Utah. Utah State Dep. Fish Game, Salt Lake City. 20 pp. + 6 fig. and 3 plates.

DAM, FISHERY, MANAGEMENT, RESERVOIR, RIVER-Green, WILDLIFE

Preliminary report pertaining to the impact of Flaming Gorge Dam and future reservoir on management of fish and wildlife in the Flaming Gorge area on the Green River.

1004. Utah State Department of Fish and Game. 1964. Reservoir fisheries investigation: Glen Canyon Unit, Upper Colorado River Storage Project. Utah State Dep. Fish Game, Salt Lake City, Annu. Prog. Rep. 1. 30 pp.

FISH, LIMNOLOGY, MANAGEMENT, RESERVOIR, RIVER-Colorado, SURVEY

Survey of the limnology and fishery of Lake Powell after the closure of the Glen Canyon Dam.

1005. Utah State Department of Fish and Game. 1969. Glen Canyon Reservoir post-impoundment investigation. Utah State Div. Fish Game, Salt Lake City, Prog. Rep. 6. 16 pp.

FISH, LIMNOLOGY, MANAGEMENT, RESERVOIR, RIVER-Colorado

Survey of the limnology and fishery of the Glen Canyon Reservoir in 1969.

1006. Utah State Department of Health. 1967. Water quality standards and implementation plan for interstate waters in Utah. Utah State Dep. Health, Salt Lake City. 26 pp. + 21 exhibits.

MANAGEMENT, POLICY, WATER QUALITY

Plan for maintaining water quality standards in Utah's waters.

1007. Utah State University. 1976. Utah publication retrieval system: a master bibliography and index to publications of state government agencies. Merrill Library, Utah State Univ., Logan. Various pagination.

BIBLIOGRAPHY, RESOURCES

A comprehensive listing of references of federal and state publications for Utah by key words, authors, geography, and agency.

1008. Utah State University Foundation. 1969. Characteristics and pollution problems of irrigation return flows. (Final Rep. to U. S. Fed. Water Pollut. Control Admin., Contract 14-12-408.) Utah State Univ. Foundation, Logan. 265 pp.

IRRIGATION, POLLUTION, WATER QUALITY

Discusses the economic and legal aspects of the characteristics of irrigation return flows to pollution and impacts on livestock, fish, and wildlife.

1009. University of Utah, Department of Anthropology. Various dates. Anthropological papers. Univ. Utah, Dep. Anthropol., Salt Lake City. Various pagination.

ARCHAEOLOGY, ECOLOGY, FISH, GEOLOGY, HISTORY, INSECT, INVERTEBRATE, RIVER-Colorado, Green, Gunnison, VEGETATION

Two series of papers - Glen Canyon and Upper Colorado - have numerous papers on the subjects provided by the key words. Selected references on fish and invertebrates are cited separately in this bibliography.

1010. Utah Water Research Laboratory. 1975. Colorado River Regional Assessment Study. Utah Water Res. Lab., Utah State Univ., Logan. 4 Vol.

PRWG-165-1. Executive summary, basin profile, and report digest. 239 pp.
PRWG-165-2. Detailed analysis: narrative description, data methodology, and documentation. 479 pp.
PRWG-165-3. Area-specific water quality analysis and environmental assessment. 218 pp. + appendices.
PRWG-165-4. Bibliography and appendices. 281 pp.

DESCRIPTION, DISTRIBUTION, ECOLOGY, FISH, HISTORY, INVERTEBRATE, LIMNOLOGY, MINERAL, MODEL, POLLUTION, PRECIPITATION, RECLAMATION, RIVER-Colorado, SALINITY, SEDIMENT, SOIL, WATER QUALITY, WATER QUANTITY

Comprehensive review of the physical, technological, economic, institutional, and social impacts of PL 92-500. It is all of 11 regional studies that were prepared for the National Commission on Water Quality.

1011. Utah Water Research Laboratory and Utah Division of Water Resources. 1975. Impacts of energy development on Utah water resources. Proc. Annu. Conf. Water Resour. Assoc., Utah Sect. 3. 246 pp.

ECONOMICS, ENERGY, LAW, MANAGEMENT, POLICY, RIVER-Colorado, SOCIOLOGY, WATER QUALITY, WATER QUANTITY

Conference on the technical, economic, social, legal, and political factors associated with water development for energy in Utah.

1012. Utley, R. M. 1963. The Colorado River in the history of North America. Santa Fe, New Mexico. 18 pp.

HISTORY, RIVER-Colorado

Concise account of the history of the Colorado River published by the author.

1013. Utton, A. E., editor. 1973. Pollution and international boundaries: United States-Mexican environmental problems. Univ. New Mexico Press, Albuquerque. 135 pp.

LAW, MANAGEMENT, RIVER-Colorado, WATER QUALITY

This book contains 12 pages on environmental problems that exist between the United States and Mexico that relate to laws on pollution and international relations concerning the Colorado River.

1014. Uyeno, T. 1960. Osteology and phylogeny of the American cyprinid fishes allied to the genus Gila. Ph. D. Thesis, Univ. Michigan, Ann Arbor. 174 pp.

ARCHAEOLOGY, FISH, HISTORY, LIFE HISTORY

This dissertation addresses the problem of the imperfect classification of cyprinid fishes. The systematic problem is approached by stressing osteological characters as a standard base. Gila atraria served as a type for comparison because it appeared to have the most generalized form. The purpose was to establish a standard for future paleontological studies of Cenozoic cyprinids and for phylogenetical comparisons with Eurasian minnows. The hypothetical phylogeny of the genus Gila and its allies is presented.

1015. Van Bradt, N. C. 1932. Historical development of the major federal irrigation projects in the Colorado River drainage basin and their significance in our national development. M. A. Thesis, Univ. Colorado, Boulder. 183 pp.

ECONOMICS, HISTORY, IRRIGATION, RECLAMATION, RIVER-Colorado

Reviews early and modern irrigation in the Southwest; gives a geographical and historical review of the Colorado River, and describes the Uncomphagre and Grand Valley Reclamation Projects in Colorado.

1016. van der Leeden, F. 1971. Groundwater: a selected bibliography. Water Information Center, Inc. The Maple Press Company, Port Washington, New York. 116 pp.

GROUNDWATER, HYDROLOGY

Bibliography containing general references on all aspects of groundwater and its development.

1017. van der Leeden, F. 1976. Water resources of the world. Water Information Center, Inc., The Maple Press Company, Port Washington, New York. 560+ pp.

CLIMATE, GROUNDWATER, IRRIGATION, RESOURCES, RUNOFF, STREAMFLOW, WATER QUANTITY

Presents comprehensive statistics on the climate and characteristics of the world's major rivers, lakes, and reservoirs, including data on streamflow and runoff, groundwater, water use, irrigation, industrial and public water requirements. Complete bibliographic references for all data are given at the end of each continental section.

1018. Vanicek, C. D. 1967. Ecological studies of native Green River fishes below Flaming Gorge Dam, 1964-1966. Ph. D. Thesis, Utah State Univ., Logan. 124 pp.

AGE-GROWTH, DISTRIBUTION, FISH, FISH-rare, FOOD HABITS, LIFE HISTORY, RIVER-Green

Flaming Gorge Dam has caused a major change in the ecology of the downstream Green River by alteration of seasonal flow and water temperature patterns as far as the mouth of the Yampa River, 65 miles below the dam. As a result, native fish populations, particularly in the first 26 miles below the dam, have been largely replaced by introduced rainbow and brown trout (Salmo gairdneri and S. trutta). Below the mouth of the Yampa River, fish populations are similar to those reported before impoundment.

1019. Vanicek, C. D., and R. H. Kramer. 1969. Life history of the Colorado squawfish, Ptychocheilus lucius, and the Colorado chub, Gila robusta, in the Green River in Dinosaur National Monument, 1964-1966. Trans. Am. Fish. Soc. 98(2): 193-208.

DISTRIBUTION, FISH, FISH-rare, FOOD HABITS, LIFE HISTORY, RIVER-Green, STREAMFLOW, TEMPERATURE

Documents the reduction in range of these fish following the closure of the Flaming Gorge Dam on the Green River in late 1962. It also summarizes the first data describing the life history of these two fish which are endemic to the Colorado River system.

1020. Vanicek, C. D., R. H. Kramer, and D. R. Franklin. 1970. Distribution of Green River fishes in Utah and Colorado following closure of Flaming Gorge Dam. Southwest Nat. 14(3): 297-315.

ABUNDANCE, DISTRIBUTION, FISH, FISH-rare, RIVER-Green

Studies of fish populations from the dam downstream to Ouray, Utah, were conducted from July 1963 to October 1966. The objectives of these studies were (1) to study changes in river environment associated with closure of the dam; (2) to determine species composition, distribution, and abundance of fishes in the study section; and (3) to compare 1963-66 distribution of fishes with that reported in pre-impoundment collections. A total of 24,040 fish of 9 indigenous and 12 exotic species were taken in 667 collections by electrofishing gear, gill nets, seines,and special fry sampling gear. During years of high summer discharge from the dam with resultant lower water temperatures (1964 and 1966), no young of the year of any native fishes were found in the Green River above the mouth of the Yampa River.

1021. Van Tassel, A. J., editor. 1975. The environmental price of energy. D. C. Heath and Co., Lexington, Mass. 326 pp.

ECOLOGY, ENERGY, WATER QUANTITY

Contains a chapter on "Oil shale: a huge resource of low-grade fuel," pages 289-296. It also emphasizes that environmental costs of oil shale development will be high and that water will be critical and limit production.

1022. Varley, J. D. 1967. Plankton periodicity as related to the chemical, physical, and biological environment of Flaming Gorge Reservoir, Utah-Wyoming. M. S. Thesis, Univ. Utah, Salt Lake City. 301 pp. (Published as Utah State Dep. Nat. Resour., Div. Fish and Game, Publ. 67-6. 192 pp.)

ABUNDANCE, DISTRIBUTION, LIMNOLOGY, PLANKTON, RESERVOIR, RIVER-Green, WATER QUALITY

Forty-one species of net phytoplankton and 13 species of net zooplankton were collected and identified. Vertical distribution of the plankton was similar in all areas of the reservoir and during all seasons of the year. Most organisms were concentrated in the upper 60 feet of water. Horizontal distribution was patchy and discontinuous.

1023. Varley, J. D. 1968. The effects of rainbow trout on the quantity, size, and species composition of the zooplankton in Flaming Gorge Reservoir. Proc. Annu. Conf. West. Assoc. State Game Fish Comm. 48: 534-549.

FISH, FOOD HABITS, PLANKTON, RIVER-Green

Reports the effect of rainbow trout predation on the zooplankton population in Flaming Gorge Reservoir.

1024. Varley, J. D. 1979. The influence of rainbow trout grazing on zooplankton in Flaming Gorge Reservoir. Utah Div. Wildl. Resources, Publ. No. 75-5. 11 pp.

FISH, FOOD HABITS, INVERTEBRATE, PLANKTON, RESERVOIR, RIVER-Green

Sampling of zooplankton and rainbow trout stomachs that were collected for 5 years indicated that trout grazed significantly on zooplankton and thereby caused important modifications in the plankton community in Flaming Gorge Reservoir. These data indicated that trout had a negative influence on the abundance and size of the copepods and cladocerans and the species composition of the zooplankton. The impact of these phenomena on the sport fishery for trout is discussed.

1025. Varley, J. 1980. Variations in the horizontal abundance of certain plankton species in Flaming Gorge Reservoir. Utah Div. Wildl. Resour. Publ. 75-6. In press.

ABUNDANCE, DISTRIBUTION, INVERTEBRATE, PLANKTON, RESERVOIR, RIVER-Green

Summarizes the abundance and distribution of plankton in Flaming Gorge Reservoir.

1026. Varley, J. D., and J. C. Livesay. 1976. Utah ecology and life history of the Utah chub, *Gila atraria*, in Flaming Gorge Reservoir, Utah-Wyoming. Utah Div. Wildl. Resources, Pub. 76-16. 29 pp.

ECOLOGY, FISH, LIFE HISTORY, RESERVOIR, RIVER-Green

Gives a detailed description of the ecology and life history of the rapidly expanding Utah chub population in Flaming Gorge Reservoir.

1027. Varley, J. D., A. F. Regenthal, B. Nielson, R. W. Wiley, F. W. Jackson, and D. Dufek. 1970. Green River and Flaming Gorge Reservoir post-impoundment investigations. Joint Rep., Utah State Div. Wildl. Resour., Salt Lake City, and Wyoming Game Fish Comm., Cheyenne, Prog. Rep. 7. 28 pp. + appendix.

FISH, MANAGEMENT, RIVER-Green, SURVEY

Describes a survey of the limnology and fishery of Green River and Flaming Gorge Reservoir in 1970.

1028. Varley, J. D., A. F. Regenthal, and R. W. Wiley. 1971. Growth of rainbow trout in Flaming Gorge Reservoir during the first six years of impoundment. Pages 121-136 *in* G. E. Hall, ed. Reservoir fisheries and limnology. Am. Fish. Soc., Spec. Publ. 8.

AGE-GROWTH, FISH, RESERVOIR, RIVER-Green

Discusses age, growth, and relative condition of more than 6,000 rainbow trout for the first 6 years of impoundment of Flaming Gorge Reservoir, Utah-Wyoming (1963-68), on the Green River.

1029. Varrin, R. D., L. D. James, J. C. Frey, D. O. Anderson, C. C. Warnick, J. R. Runkles, and N. A. Evans. Role of water in the energy crisis. Natl. Tech. Inf. Serv., Springfield, Va. PB-232 404. 219 pp.

ENERGY, RIVER-Colorado, WATER QUANTITY

Reviews the role of water in energy development by region in the United States. The Colorado River-Great Basin was reviewed by N. A. Evans.

1030. Veatch, A. C. 1907. Geography and geology of a portion of southwestern Wyoming, with special reference to coal and oil. U. S. Geol. Surv. Prof. Pap. 56. 178 pp. + plates and maps.

GEOLOGY, MINERAL, RIVER-Green

Discusses the geology of a segment of the upper Green River. Primarily concerned with the economic aspects of the coal and oil deposits in the extreme southwest corner of Wyoming and a small portion of Utah.

1031. Vincent, J. R., and J. D. Russell. 1971. Alternatives for salinity management in the Colorado River. Water Resour. Bull. 7(4): 856-866.

ECONOMICS, SALINITY, WATER QUALITY

On the basis of projected development, salinity concentrations are predicted to exceed 1200 mg/l at Imperial Dam, California, by the year 2010. Annual losses to the basin economy associated with increased salinity will exceed $50 million by the year 2010. Five basic alternatives for coping with the problem are presented and evaluated in this paper: (1) do nothing; (2) adopt arbitrary salinity standards; (3) limit development; (4) control salt discharges at a cost equal to the cost of doing nothing, or (5) minimize total costs to the basin.

1032. VTN Consolidated, Inc. and Museum of Northern Arizona. 1978. Fish, wildlife and habitat assessment: San Juan River, New Mexico and Utah - Gallop-Navajo Indian Water Supply Project. U. S. Bureau of Reclamation, Upper Colorado River Region, Salt Lake City, Utah. 241 pp.

FISH, RECLAMATION, RIVER-San Juan, SURVEY, WATER SUPPLY

Reviews the potential effect of a water development project on the fish, wildlife, and their habitats in the San Juan River.

1033. Wagner, F. H., and G. W. Workman. 1961. The wildlife of Dead Horse Point State Park and vicinity. Dep. Wildl. Sci., Utah State Univ., Logan. 103 pp. (Unpubl. manuscr.)

FISH, RIVER-Colorado, SURVEY, WILDLIFE

Survey of Dead Horse Point in southeastern Utah that includes mammals, birds, amphibians, reptiles, and fish. Includes a checklist of fish that were collected from the Colorado and Green Rivers near their confluence.

1034. Wagner, J. R. 1975. Institutional arrangements for reducing conflict over water quality in international rivers. Univ. Arizona, Tucson, Inst. Gov. Res.,Off. Water Res. Technol., Washington, D. C. Completion Rep. Natl. Tech. Inf. Serv., Springfield, Va. PB-244 821/5st. 50 pp.

LAW, MANAGEMENT, POLLUTION, RIVER-Colorado, SALINITY, SOCIOLOGY, WATER QUALITY

Institutional arrangements coping with the problem of water quality in international rivers are examined. Findings are restricted to the evidence available and are tentative only. Both the International Boundary and Water Commission (United States-Mexico) and the International Joint Commission (United States-Canada) are adequately meeting technical problems of quality control in their respective jurisdictions. Political aspects of water policy causes delays in solving the salinity problem on the Colorado River.

1035. Walker, W. R. 1970. Hydro-salinity model of the Grand Valley. M. S. Thesis, Colorado State Univ., Fort Collins. 94 pp.

GROUNDWATER, HYDROLOGY, MINERAL, MODEL, RIVER-Colorado, SALINITY

The contribution to the salt load of the Colorado River as it passes through the Grand Valley in Colorado is the most significant increase in the upper basin. Seepage and deep percolation losses enter shallow saline aquifers, resulting from interaction with salt deposits in the underlying Mancos shale formation. This study produced a model of the groundwater, hydrology, and salinity in the Grand Valley.

1036. Walkins, T. H. 1969. The Colorado River-the story of a river and its canyons. American West Publ. Co., Palo Alto, Calif. 310 pp.

DESCRIPTION, HISTORY, RIVER-Colorado

Describes the Colorado River and its canyons and provides a broad history of this river. Numerous color photographs as well as historical black-and-white photographs appear throughout the book.

1037. Wallis, O. L. 1951. The status of the fish and fauna of the Lake Mead Recreation Area, Arizona-Nevada. Trans. Am. Fish. Soc. 80(1950): 84-92.

ABUNDANCE, ALTERATION, DISTRIBUTION, FISH, MANAGEMENT, RIVER-Colorado

The Colorado River flows for nearly 225 miles through the Lake Mead National Recreational Area, Arizona-Nevada. Its character has been controlled and changed as the result of construction of Hoover and Davis Dams. There were 3 native and 11 exotic species of fish. Six additional fishes native to the Colorado River Basin and two other alien forms may occur. Competition with the exotic species and changes in ecological conditions of the river have apparently brought about decline in the numbers of native fishes. The largemouth bass is the most important game species in Lake Mead and the rainbow trout in Lake Mohave.

1038. Ward, J. C., and S. E. Reinecke. 1972. Water pollution potential of snowfall on spent oil shale residues. Dep. Civil Eng., Colorado State Univ., Fort Collins, and Natl. Tech. Inf. Serv., Springfield, Va. PB-210 930. 68 pp.

HYDROLOGY, POLLUTION, PRECIPITATION, RUNOFF, SNOWPACK, WATER QUALITY

Because more than half of the precipitation in the oil shale area falls as snow, the effects of snowfall on the residues and the resulting changes in water quality were considered. The chemical properties of the shale residues before and after snowfall were determined, as well as the water chemistry of the runoff.

1039. Ward, J. V. 1976. Effects of flow patterns below large dams on stream benthos: a review. Pages 235-253 in J. F. Orsborn and C. H. Allman, eds. Proceedings of a symposium and specialty conference on instream flow needs. Vol. 1. Am. Fish. Soc., Washington, D. C.

DAM, INVERTEBRATE, STREAMFLOW

Excellent summary of the impacts of dams on macroinvertebrates from changes in streamflows.

1040. Waring, G. A. 1961. Groundwater in part of southeastern Utah and southwestern Colorado, with a chapter on Moab and Spanish Valleys. U. S. Geol. Surv., Denver, Colo. 117 pp.

GOUNDWATER, RIVER-Colorado, SURVEY, WATER RESOURCE

Survey of groundwater resources in Moab and Spanish Valleys.

1041. Water Resources Council. 1971. Upper Colorado Region Comprehensive Framework Study. Upper Colorado Region State-Federal Inter-agency Group, Pacific Southwest Inter-Agency Committee, Water Resources Council. Main Report-State and Federal Comments, Exhibits A-D. 112 pp. Appendices:

I. History of study. 42 pp.
II. The region. 38 pp.
III. Legal and institutional environments. 245 pp.
IV. Economic base and projections. 213 pp.
V. Water resources. 66 pp.
VI. Land resources and use. 142 pp.
VII. Mineral resources. 86 pp.
VIII. Watershed management. 86 pp.
IX. Flood control. 78 pp. with supplements A to C.
X. Irrigation and drainage. 98 pp.
XI. Municipal and industrial water. 62 pp.
XII. Recreation. 195 pp.
XIII. Fish and wildlife. 108 pp. + 6 maps.
XIV. Electric power. 92 pp.
XV. Water quality, pollution control, and health factors. 219 pp.
XVI. Shoreline protection and development (Not applicable to Upper Colorado region)
XVII. Navigation (Not applicable to Upper Colorado region)
XVIII. General program and alternatives. 164 pp.

AGRICULTURE, DESCRIPTION, ECONOMICS, FISH, FLOOD, GEOLOGY, HISTORY, IRRIGATION, LAW, MANAGEMENT, MINERAL, POWER, RECLAMATION, RECREATION, STREAMFLOW, WATERSHED, WATER QUALITY, WATER QUANTITY

An intensive framework and plan for the development and management of water and related land resources of the Upper Colorado Region, prepared at the field level by a state-federal inter-agency group. Each major topic is covered in a separate appendix.

1042. Water Resources Policy Commission. 1950. A water policy for the American people. Vol. 1 - General report, 18 pp.; Vol. 2 - Ten rivers in America's future: No. 5 - The Colorado, 108 pp. U. S. Water Resour. Policy Comm., Washington, D. C.

MANAGEMENT, POLICY, RIVER-Colorado

A U. S. policy on water use in the United States, with a section on the Colorado River.

1043. Water Resources Scientific Information Center. 1972. Mercury in water: a bibliography. U. S. Off. Water Resour. Res., Water Resour. Sci. Inf. Cent, WRSIC 71-207, Washington, D. C. 297 pp.

MINERAL, POLLUTION, WATER QUALITY

Recent bibliography on references pertaining to mercury in water.

1044. Waters, F. 1946. The Colorado. Holt, Rinehart, and Wilson, Inc., New York. 400 pp.

ARCHAEOLOGY, HISTORY, RIVER-Colorado

Popular narrative of the people and history along the Colorado River.

1045. Watson, E. H. 1948. Digest of Utah Water law. Vol. 1, 330 pp. Vol. 2, 379 pp. Utah State Engineer, Salt Lake City.

LAW, WATER QUANTITY

Volume one provides case histories with a digest giving brief statement of facts and principles of law that are discussed. Volume two provides a subject digest that compiles similar case histories.

1046. Wayman, C. H. 1975. Proceedings of Regional Energy EIS (Environ. Impact Statement) Seminar. Sponsored by the Denver Federal Executive Board. Denver, Colo. 172 pp.

ECOLOGY, ENERGY, MANAGEMENT, POLICY

A seminar on environmental impacts that might result from energy development in the Rocky Mountain area.

1047. Weatherford, G. D., and G. C. Jacoby. 1975. Impact of energy development on the law of the Colorado River. Nat. Resour. J. 15: 171-213.

ALLOCATION, ENERGY, HISTORY, LAW, MANAGEMENT, POLICY, RIVER-Colorado, WATER QUANTITY

Detailed discussion of the historical-legal aspects of water development on the Colorado River, its allocation and projected demands, water rights, management, and planning. Energy development was viewed as the most prominent, rapidly changing, non-agricultural variable in the upper Colorado River Basin today.

1048. Weaver, R. 1968. Meteorology of major storms in western Colorado and eastern Utah. U. S. Dep. Commer., NOAA (Natl. Oceanogr. Atm. Admin.), Weather Bur., Washington, D. C., Tech. Memo. HYDRO-7. 75 pp.

CLIMATE, PRECIPITATION

Outlines the meteorological conditions associated with major storms in western Colorado and eastern Utah.

1049. Weber, D. T. 1959. Effects of reduced stream flows on the trout fishery below Granby Dam, Colorado. M. S. Thesis, Colo. State Univ., Fort Collins. 149 pp.

ECOLOGY, FISH, FOOD HABITS, INVERTEBRATE, RIVER-Colorado, STREAMFLOW

Study of the effects of streamflow on fish and invertebrates below Granby Dam on the Colorado River in north-central Colorado.

1050. Weeks, J. B., G. H. Leavesley, F. A. Welder, and G. J. Saulnier, Jr. 1974. Simulated effects of oil-shale development on the hydrology of Piceance Basin, Colorado. U. S. Geol. Surv. Prof. Pap. 908. 84 pp. + plates and maps.

GEOLOGY, GROUNDWATER, HYDROLOGY, RIVER-White tributary

The hydrology of the rich oil-shale area was described and digital models of watershed and goundwater were used to simulate the hydrologic system. Piceance Creek is a major tributary of the White River.

1051. Weisbecker, L. W. 1972. Technology assessment of winter orographic snowpack augmentation in the Upper Colorado River Basin: the impacts of snow enhancement. Stanford Research Inst., Menlo Park Calif. Final Rep. to Natl. Sci. Foundation, Washington, D. C., Contract NSF-C641 and Natl. Tech. Info. Serv., Springfield, Va. PB-222 873/2. Two vols.

Vol. I. Summary report. 50 pp.
Vol. II. Technical report. 629 pp.

CLOUD SEEDING, ECOLOGY, ECONOMICS, LAW, PRECIPITATION, RIVER-Colorado, SOCIOLOGY, WATER QUANTITY

Covers an assessment of the economic, legal, social, and ecological impacts of a proposed project to increase the flow of the Colorado River by seeding clouds during winter orographic storms to increase snowpack and hence spring runoff.

1052. Weisbecker, L. W. 1974. Snowpack, cloud-seeding, and the Colorado River: a technology assessment of weather modification. Univ. Oklahoma Press, Norman. 86 pp.

ALTERATION, CLIMATE, CLOUD SEEDING, ECOLOGY, ECONOMICS, LAW, MANAGEMENT, PRECIPITATION, RUNOFF, SNOWPACK, STREAMFLOW, WATER QUALITY, WATER QUANTITY

Report on the technological assessment of augmentation of the winter orographic snowpack in the Colorado River Basin, consisting of cost-effectiveness analyses; economic, social, and environmental impacts; public attitudes; legal and jurisdictional consequences; and alternative means of alleviating water problems in the area.

1053. Welsh, S. L. 1957. An ecological survey of vegetation of the Dinosaur National Monument. M. S. Thesis, Brigham Young Univ., Provo, Utah. 86 pp.

ECOLOGY, SURVEY, VEGETATION

Survey of vegetation in Dinosaur National Monument, Colorado-Utah.

1054. Wennergren, E. B. 1975. Economic value of water-oriented recreational quality. Utah State Univ., Dep. Econ., Logan. 27 pp.

ECONOMICS, RECREATION, WATER RESOURCE

Establishes an economic value for the quality of water-oriented recreation.

1055. Wernsman, G. R. 1973. Systematics of native Colorado cutthroat trout. M. S. Thesis, Colorado State Univ., Fort Collins. 64 pp.

ABUNDANCE, DESCRIPTION, ECOLOGY, FISH

The systematics of four subspecies of cutthroat trout found in Colorado are summarized, including the Colorado River cutthroat trout, Salmo clarki pleuriticus.

1056. Wesche, T. A. 1973. Parametric determination of minimum stream flow on trout. Water Resour. Res. Inst., Univ. Wyo. (Laramie), Water Resour. Ser. 37. 102 pp.

FISH, HYDROLOGY, MANAGEMENT, STREAMFLOW, WATER QUANTITY

Parametric approach to determine suitable minimum streamflow for the preservation of trout populations in two relatively small streams (average daily flows about 30 cfs) in southeastern Wyoming. The results are applicable to the headwater streams of the upper Colorado River.

1057. Wesche, T. A. 1974. Relationship of discharge reductions to available trout habitat for recommending suitable streamflows. Water Resour. Res. Inst., Univ. Wyo. (Laramie). Water Resour. Ser. 53. 71 pp.

ECOLOGY, FISH, STREAMFLOW

Relates available trout habitat to reduced streamflows.

1058. Wesche, T. A. 1976. Development and application of a trout cover rating system for IFN determination. Pages 224-234 in J. F. Orsborn and C. H. Allman, eds. Proceedings of a symposium and specialty conference on instream flow needs. Vol. 1. Am. Fish. Soc., Washington, D. C.

FISH, HABITAT, STREAMFLOW

Describes a system for rating trout habitat that was based on small streams in southeastern Wyoming containing brown trout. This system can be applied to the numerous trout streams in the Rocky and Uinta Mountains in the upper Colorado River basin.

1059. Western Resources Conference, 1964. 1965. New horizons for resources research: issues and methodology. Univ. Colorado Press, Boulder. 315 pp.

MANAGEMENT, MINERAL, WATER QUANTITY

An annual conference on natural resources sponsored by the Colorado School of Mines, Colorado State University, and the University of Colorado. Includes a chapter on "Oil Shale-1964 or 1984," including coverage on economic, legal, political, and administrative problems in oil shale mining.

1060. Weston, W. 1903. The Yampa coal field of Routt County, Colorado on the projected line of the Denver, Northwestern and Pacific Railway Company (Moffat Road). Report to D. H. Moffat, President, Denver, Northwestern and Pacific Railway Co., Denver, Colo. 53 pp. + map.

HISTORY, MINERAL, RESOURCES

Report on coal seams in the Yampa coal field, documented with photographs. A copy is in the Earth Science Library, Univ. Colorado, Boulder.

1061. Weston, W. 1905. The hydrocarbon field of western Colorado and eastern Utah on the projected line of the Denver, Northwestern and Pacific Railway. Report to A. C. Ridgway, General Manager, Denver, Northwestern and Pacific Railway, Denver, Colo. 39 pp. + map.

HISTORY, RESOURCES

Report on the hydrocarbon resources of western Colorado and eastern Utah. A copy is in the Earth Science Library, Univ. Colorado, Boulder.

1062. Wheaton, R. Z. 1967. Analysis of the influence of watershed management in water yield. Ph. D. Thesis, Univ. California, Davis. 124 pp.

GROUNDWATER, PRECIPITATION, SOIL, WATERSHED, WATER QUANTITY

Analyzes the factors of precipitation, evaporation, transpiration, soil, and groundwater on the water yield from a watershed.

1063. Whetstone, G. A. 1970. Interbasin diversion of water: an annotated bibliography. Water Resour. Cent. Tex. Tech. Univ., Publ. 70-2. 323 pp.

BIBLIOGRAPHY, WATER QUANTITY

Extensive bibliography on interbasin diversion of water.

1064. Whitaker, G. L. 1970. Daily water-temperature records for Utah streams, 1944-1968. U. S. Geol. Surv., Salt Lake City, Utah, Basic-Data Release 19. 119 pp.

HYDROLOGY, TEMPERATURE, WATER QUALITY

Summarizes water-temperature data in tabular form that were collected daily between 1944 and 1968 by the U. S. Geological Survey.

1065. White, G. F. 1956. The future of arid lands. Am. Assoc. Advance. Sci., Washington, D. C. Publ. 43. 453 pp.

RESOURCES, VEGETATION, WATER QUANTITY

Contains papers and recommendations from the International Arid Land meeting in New Mexico, 26 April-4 May 1955. The papers are arranged under the following headings: The broad view; Variability and predictability of water supply; Better use of present resources; Prospects for additional water resources; and Better adaptation of plants and animals to arid conditions.

1066. Wiard, L. A. 1962. Floods in New Mexico, magnitude and frequency. U. S. Geol. Surv. Circ. 464. 13 pp.

FLOOD, RIVER-San Juan, STREAMFLOW

Presents a method for determining the magnitude and frequency of floods that can be expected in New Mexico. The streamflows for mean annual floods in various regions in the state were determined. Drainage area was the only basin characteristic that had an appreciable effect on streamflows during the mean annual floods, except in two regions where a relation also existed with altitude.

1067. Wildlife Management Institute. 1974. Placing American wildlife management in perspective. Wildlife Management Institute, Washington, D. C. 29 pp.

MANAGEMENT, WILDLIFE

Summarizes wildlife management in the United States and how proper management can restore species populations that have become low.

1068. Wiley, R. W. 1975. Fishermen use and harvest, Fontenelle-Green River tailwaters fishery. Wyo. Game Fish Dep., Cheyenne. Fed. Aid Proj. F-44-R-1; Obj. 1, Job 1. 16 pp.

FISHERY, RESERVOIR, RIVER-Green

Summarizes the fishermen use and harvest of trout in the tailwaters of Fontenelle Reservoir in 1970-74.

1069. Wiley, R. W. 1978. Trends in fish population, 1963 through 1976 -- 14 years of gillnetting, Flaming Gorge Reservoir. Wyoming Game Fish Dep., Fish. Res. Rep., Monogr. Ser. 1: 17-29.

ABUNDANCE, FISH, RESERVOIR, RIVER-Green

Rainbow trout were most abundant in gill net catches from Flaming Gorge Reservoir until 1965. After that time, the fish species composition began to change -- favoring non-game species, primarily Utah chub, flannelmouth sucker, and white sucker. The decline in the abundance of rainbow trout was attributed to increased fishing effort and competition with non-game fishes and large predator trout.

1070. Wiley, R. W., D. J. Dufek, and R. G. McKnight. 1975. Preliminary evaluation of sodium cyanide (Cyanobrik) used in sampling fish populations in the Green and Blacks Fork Rivers. Proc. Annu. Conf. West. Assoc. State Game Fish Comm. 55: 249-254.

FISH, MANAGEMENT, RIVER-Green, SURVEY, TEMPERATURE

Discussion and evaluation of the use of sodium cyanide as a technique for fish sampling; covers the toxicity, dissipation rates, effects of flow, temperature, and pH on trout, whitefish, sculpins, and suckers.

1071. Wiley, R. W., and J. W. Mullan. 1975. Philosophy and management of the Fontenelle Green River tailwater trout fisheries. Pages 28-31 in W. King, ed. Wild trout management. Trout Unlimited, Inc., Denver, Colo.

FISHERY, MANAGEMENT, RESERVOIR, RIVER-Green

Offers the philosophy and management of the trout fishery in the tailwaters of Fontenelle Reservoir. Provides the fishery statistics for this tailwater for 1970-1973.

1072. Wiley, R. W., and J. D. Varley. 1972. The diet of rainbow and brown trout from Flaming Gorge Reservoir, 1964 through 1969. Joint Report, Wyoming Game Fish Dep., Cheyenne, and Utah Div. Wildl. Resour., Salt Lake City. 114 pp.

FISH, FOOD HABITS, RESERVOIR, RIVER-Green

Summarizes the food habits of rainbow and brown trout during the first 6 years of impoundment of Flaming Gorge Reservoir.

1073. Wiley, R. W., and J. D. Varley. 1978. The diet of rainbow and brown trout from Flaming Gorge Reservoir, 1964 through 1969. Wyoming Game Fish Dep., Fish. Res. Rep., Monogr. Ser. 1: 1-16.

FISH, FOOD HABITS, RESERVOIR, RIVER-Green

The primary food of rainbow trout (n = 1,343) was zooplankton. Brown trout (n = 64) also included zooplankton in a major part of their diets and, in addition, used significant quantities of forage fish. Growth of both species was better than average, probably because of the high availability of food. Brown trout 126 to 445 mm included significantly greater amounts of fish in their diet than did rainbow trout, but fish of both species over 457 mm took comparable quantities of fish.

1074. Williams, H. J. 1951. The operation of Taylor Reservoir and its effect on Gunnison River fishing. Fish. Manage. Colorado Dep. Game and Fish, Denver. 28 pp.

ALTERATION, FISHERY, MANAGEMENT, RESERVOIR, RIVER-Gunnison

Summarizes the effect of Taylor Dam on fly fishing in the Gunnison River between Gunnison and Sapinero.

1075. Williams, J. D., and D. K. Finnley. 1977. Our vanishing fishes: can they be saved? Frontiers (Acad. Nat. Sci., Philadelphia) 41(4): 21-32.

FISH-rare, MANAGEMENT, RIVER-Colorado

Projects ideas on preserving native fishes in the United States.

1076. Williams, J. E. 1978. Taxonomic status of *Rhinichthys osculus* (Cyprinidae) in the Moapa River, Nevada. Southwest. Nat. 23 (3): 511-518.

DISTRIBUTION, FISH, RIVER-Colorado

Rhinichthys osculus is found throughout the Colorado River basin. Specimens collected from the Moapa River were examined to determine their taxonomic status relative to other populations of *R. osculus* in southern Nevada. The Moapa River population is distinct and is regarded as a new subspecies *R. osculus moapae*. The new subspecies is characterized by adaptations to its swift water habitat, including expansive, falcate dorsal and anal fins and an expansive, deeply forked caudal fin.

1077. Williams, J. S. 1975. The natural salinity of the Colorado River. Utah Water Res. Lab., Utah State Univ., Logan, 18 pp.

RIVER-Colorado, SALINITY, WATER QUALITY

Reviews the salinity increases in the Colorado River from natural sources.

1078. Wilson, L. 1972. Seasonal sediment yields of U. S. rivers. Water Resour. Res. 8(6): 1470-1479.

HYDROLOGY, SEDIMENT, WATER QUALITY

Reviews sediment-water relationships as affected by hydrology, erosion, drainage basin, and climate.

1079. Wilson, L., M. E. Olsen, T. B. Hutchings, A. R. Southard, and A. J. Erickson. 1975. The soils of Utah. Utah State Univ., Logan. Utah Agric. Exp. Stn., Bull. 492. 94 pp. + map.

SOIL

Summarizes information on the soils found in Utah.

1080. Wiltzius, W. J. 1966-1970. Pre-impoundment investigations of the Curecanti Unit, Upper Colorado River Storage Project. Fed. Aid Proj., Colorado Game, Fish, Parks Dep., Denver.

F-31-R-1; Job 1. Review of literature. 27 pp.
F-31-R-1, 2, 3; Job 2. Determination of the chemical and physical characteristics of the Upper Gunnison River drainage. Pages 42, 1-10, 1-24 in F-31-R-1, -2, and -3 respectively.
F-31-R-1, 2, 3; Job 3. Determination of the species of fish and fish food organisms in the Upper Gunnison River drainage. Pages 63, 11-23, 25-39 in F-31-R-1, -2. and -3, respectively.

F-31-R-1, 2, 3; Job 4. Determination of spawning facilities and spawning activities in the Upper Gunnison River drainage. Pages 70, 36-48, 40-45 in F-31-R-1, -2, and -3, respectively.

F-31-R-2; Job 5. Determination of the initial fish stocking procedures for the reservoirs of the Curecanti Unit. Pages 46- 51.

FISH, INVERTEBRATE, LIMNOLOGY, RESERVOIR, RIVER-Gunnison

Broad coverage of the limnology of the Gunnison River including plants, fish, and invertebrates. Covers the history of fish abundance, introductions, and the sport fishery of the river. Post-impoundment investigations were covered in Progress Report 1 of 54 pages (1969) and Progress Report 2 of 202 pages (1971).

1081. Wiltzius, W. J. 1974. Post impoundment investigations, Curecanti Unit, Upper Colorado River Storage Project. Final Rep. Blue Mesa Reservoir. Colorado Div. Wildl., Fort Collins. 76 pp.

FISH, RESERVOIR, RIVER-Gunnison

Final report on Blue Mesa Reservoir that was constructed as a part of the Curecanti Unit, Upper Colorado River Storage Project. See Wiltzius (1966-1970) for a broad coverage of the limnology of the Gunnison River.

1082. Wiltzius, W. J. 1976. Some historic influences of reservoirs and irrigation diversions on flows, temperatures, and fish distribution in the Gunnison River. Colorado Div. Wildl., Fort Collins. 100 pp.

ABUNDANCE, AGE-GROWTH, ALTERATION, DISTRIBUTION, FISH, HISTORY, IRRIGATION, RESERVOIR, RIVER-Gunnison, STREAMFLOW, TEMPERATURE

Historic account of current conditions in the Gunnison River and response of fish to flows and temperature.

1083. Wiltzius, W. J. 1978. Some factors historically affecting the distribution and abundance of fishes in the Gunnison River. Final Rep. to Bur. Reclam., Upper Colo. Region, Salt Lake City, Utah. Colo. Div. Wildl., Fort Collins. 194 pp. + appendices.

ABUNDANCE, DAM, DISTRIBUTION, FISH, FISHERY, HABITAT, HISTORY, INVERTEBRATE, LIMNOLOGY, MANAGEMENT, RESERVOIR, RIVER-Gunnison, STREAMFLOW, TEMPERATURE

Presents a thorough review of all factors affecting fish populations in the Gunnison River. The history of man's use of the river is described including the recent construction of the Curecanti Unit of the Colorado River Storage Project. The effect of this Unit on streamflow and water temperature of the Gunnison River is documented. The early native trout fishery is described and its decline documented. The past and present distribution of native and non-native fishes is thoroughly reviewed, with emphasis on endangered species. Data from recent fishery inventories of the river are presented. Management recommendations are made for the Gunnison River and for Blue Mesa, Marrow Point, and Crystal Reservoirs.

1084. Winget, R. N., and M. K. Reichert. 1976. Aquatic survey of selected streams with critical habitats on national resource lands affected by livestock and recreation. Center for Health and Environ. Stud., Brigham Young Univ., Provo, for U. S. Bur. Land Manage., Utah State Off., Salt Lake City. 109 pp.

FISH, INVERTEBRATE, MANAGEMENT, RECREATION, RIVER-Green tributary, SURVEY, WATER QUALITY, WATERSHED

Survey of aquatic habitat and water quality baseline data for the Bureau of Land Management, including a review of the impacts from recreational use on the potable water supply and aquatic ecosystem of Rock Creek, a tributary to the Green River in Desolation Canyon; provides a description of the existing aquatic habitat, characterizes the macroinvertebrate communities, and summarizes water quality.

1085. Winn, H. E., and R. R. Miller. 1954. Native postlarval fishes of the lower Colorado River basin, with a key to their identification. Calif. Fish Game 40(3): 273-285.

DESCRIPTION, FISH, KEY, RIVER-Colorado

Description of the native post larval fishes in the lower Colorado River with a key for identification.

1086. Wollman, N. 1962. The value of water in alternative uses (with special application to water use in the San Juan and Rio Grande Basins of New Mexico.) Univ. New Mexico Press, Albuquerque. 426 pp.

ECONOMICS, LAW, RIVER-San Juan

Summarizes major water uses in the San Juan River: municipal and industrial, agricultural, and recreational. Also covers minor uses of water in this river.

1087. Woodbury, A. M., editor. 1958. Preliminary report on biological resources of the Glen Canyon Reservoir. Univ. Utah, Anthropol. Pap. 31. Glen Canyon Ser. 2. 231 pp.

FISH, RIVER-Colorado, VEGETATION

Provides checklists of the flora and fauna of the Glen Canyon area, including fishes.

1088. Woodbury, A. M. 1959. An ecological study of the Colorado River in Glen Canyon. Pages 149-176 in A. M. Woodbury, ed. Ecological studies of the flora and fauna in Glen Canyon. Univ. Utah, Dep. Anthropol., Anthropol. Pap. 40. Glen Canyon Ser. 7. 222 pp.

FISH, INVERTEBRATE, LIMNOLOGY, RIVER-Colorado, TEMPERATURE, WATER QUALITY

Provides a brief description of an aquatic survey conducted in Glen Canyon during the summer of 1958. It contains information on the water quality, fishes, and invertebrates present in the Colorado River.

1089. Woodbury, A. M. 1960. Ecological studies of the flora and fauna of Flaming Gorge Reservoir basin, Utah and Wyoming. Univ. Utah, Dep. Anthropol., Anthropol. Pap. 48. Upper Colorado River Basin Ser. 3. 243 pp.

DESCRIPTION, FISH, INVERTEBRATE, LIMNOLOGY, RIVER-Green, VEGETATION

Primarily concerned with terrestrial vegetation but also contains sections on fishes, invertebrates, and water quality in the Green River during summer 1959.

1090. Woodbury, A. M., editor. 1963. Studies of biota in Dinosaur National Monument--Utah and Colorado. Univ. Utah, Div. Biol. Sci., Inst. Environ. Biol. Res., Misc. Pap. 1. 77 pp.

CLIMATE, FISH, RIVER-Green, Yampa, STREAMFLOW, VEGETATION

Part of a general program of the National Park Service to ascertain the status of the biota of the Green River and surrounding area in Dinosaur National Monument before the impoundment of Flaming Gorge Reservoir. Includes basic water chemistry and provides lists of algae, invertebrates, terrestrial vertebrates, and terrestrial vegetation that were collected in the summer of 1962.

1091. Woodbury, A. M., and I. Musser. 1963. A limnological study of Fremont River, Capitol Reef National Monument, Utah. Univ. Utah, Div. Biol. Sci., Salt Lake City. 52 pp.

LIMNOLOGY, SURVEY

Limnological survey of the Fremont River in southeastern Utah.

1092. Wooley, R. R. 1930. The Green River and its utilization. U. S. Geol. Surv. Water-Supply Pap. 618. 456 pp. + map.

HISTORY, POWER, RESERVOIR, RIVER-Green, WATER QUALITY, WATER QUANTITY

One of a series of reports on the value and use of the Green River for reservoirs and power dams.

1093. Woolley, R. D., and K. K. Mustonen. 1975. Utah natural resources and land use information system. Merrill Library, Utah State Univ., Logan. 2302 pp.

BIBLIOGRAPHY, RESOURCES

A comprehensive bibliography coverage of Utah's natural resources and land use. An information system on microfiche with indices to key words, authors, titles, and geography. Continually updated quarterly.

1094. Workman, J. P., and J. E. Keith. 1974. Economic aspects of erosion control practices in the upper Colorado River Basin. Proc. Utah Acad. Sci. Arts Lett. 51(1): 102-108.

EROSION, RIVER-Colorado upper system, WATER QUALITY

The Upper Colorado River basin contains 1,280,000 acres of "frail lands" characterized by steep slopes, highly erodible soils derived from marine shale, extremely sparse vegetation, and a very arid climate. This basin contributes only 5% of the Upper Colorado River water flowing through Lee's Ferry in Arizona, and simultaneously contributes about 44% of the sediment load deposited in Lake Powell. This information was also covered in Workman, J. P., and J. E. Keith. 1975. Economics of soil treatments in the Upper Colorado. Pages 591-596 in Watershed Management Symposium. Am. Soc. Civil Eng. Irrigation and Drainage Division, 11-13 August 1975, Logan.

1095. Wright, C. T. 1958. Water quality in the Upper Colorado River Basin and its relation to reclamation projects. U. S. Public Health Serv., Salt Lake City, Utah. 61 pp.

RECLAMATION, RIVER-Colorado and tributaries, WATER QUALITY

Evaluates the chemical water quality data from subsampling stations in the upper basin and the effects of reclamation projects in later water use.

1096. Wydoski, R. S. 1977. Realistic management of endangered species - an overview. Proc. Annu. Conf. West. Assoc. Game Fish Comm. 57: 273-286.

FISH-rare, MANAGEMENT, RESOURCES

Provides an overview of federal legislation, expresses the moral obligation and rationale for the management of nongame species including those that are endangered, and offers some views for consideration in the realistic management of threatened and endangered species.

1097. Wydoski, R. S. 1980. Potential impacts of alterations in streamflow and water quality on fish and macroinvertebrates in the Upper Colorado River Basin. Chapter 8 in W. O. Spofford, Jr., A. L. Parker, and A. V. Kneese, eds. Energy development and the water, fish, and wildlife in the Southwest: Problems of the Upper Colorado River Basin. Resources for the Future, Washington, D. C. In press.

ABUNDANCE, ALTERATION, DAM, DISTRIBUTION, FISH, FISH-rare, INVERTEBRATE, LAW, LIMNOLOGY, RESERVOIR, RIVER-Colorado, Green, and tributaries, SALINITY, SEDIMENT, STREAMFLOW, WATER QUALITY, WATER QUANTITY

Summarizes the present knowledge of the effects of various management practices on fish and macroinvertebrates in the Upper Colorado River Basin, attempts to identify future effects of alteration in streamflow and water quality on these animals, and offers recommendations for future research.

1098. Wydoski, R. S. 1978. Responses of trout populations to alterations in aquatic environments: a review. Pages 57-92 in J. R. Moring, ed. Proc. Wild Trout - Catchable Trout Symp., Oregon Dep. Fish Wildl., Res. Develop. Section, Corvallis.

ALTERATION, BIBLIOGRAPHY, ECOLOGY, FISH, GRAZING, LAW, STREAMFLOW, VEGETATION, WATER QUALITY

Reviews the impacts of alterations to aquatic environments from agricultural practices, channelization of streams, dams, dredging, grazing, industry, mining, and urbanization on trout populations. Contains an extensive but selective bibliography that gives references for a broad perspective and magnitude of the problems that occur from such alterations and provides guidelines for minimizing the adverse effects on fish and wildlife habitat.

1099. Wydoski, R. S., and C. R. Berry, Jr. 1976. Atlas of Utah stream fishery values. Utah Coop. Fish Res. Unit, Utah State Univ., Logan. Summary - 9 pp.; Maps - 14 U.S.G.S. Scale 1:250,000: Documentation - 886 pp.

DISTRIBUTION, FISHERY, RIVER-Colorado, Green and tributaries, WATER QUALITY, WATER QUANTITY

The fishery values of all live Utah streams were ranked by using a two-way matrix table. Two major criteria were used to rank the streams: (1) status of endangered species and (2) the importance of species of high interest. The ranking was based on the population and reproductive status of the species and the watershed and water quality of the habitat from the most current information available. A total of 886 reaches of live streams were ranked and color-coded on U. S. Geological Survey maps (scale 1:250,000). The fishery values in total miles of live Utah streams were: critical - 856.2, high priority - 1583.5, substantial - 1791.1, limited - 1146.2, no value - 893.6, and unsurveyed - 603.3. Total miles of streams with endangered species included 560.4 miles that was judged as critical habitat and another 128.3 miles that was ranked as high priority habitat.

1100. Wydoski, R. S., K. Gilbert, K. Seethaler, and C. W. McAda. 1976. Annotated bibliography for aquatic resource management of the Upper Colorado River ecosystem. Utah Coop. Fish. Res. Unit, Utah State Univ., Logan. 202 pp. (Unpubl. manuscr.)

ALTERATION, FISH, FISH-rare, INVERTEBRATE, LIFE HISTORY, MANAGEMENT, PLAN, RESOURCE, RIVER-Colorado, WATER QUALITY, WATER QUANTITY, WILDLIFE

A comprehensive annotated bibliography covering a wide variety of topics including biological, economical, sociological, and political factors that should be considered for intelligent and effective management of the upper Colorado River ecosystem.

1101. Wyoming Department of Environmental Quality. 1974. Wyoming water quality rules and regulations. Wyoming Dep. Environ. Qual., Water Qual. Div., Cheyenne. 12 pp.

LAW, POLICY, WATER QUALITY

Summarizes the regulations concerning water quality in the State of Wyoming.

1102. Wyoming Department of Environmental Quality. 1976. State of Wyoming water quality inventory - 305(B) report. Wyoming Dep. Environ. Qual., Water Qual. Div., Cheyenne. 60 pp.

RIVER-Green, SURVEY, WATER QUALITY

Inventory of the water quality in the State of Wyoming, including information on the Green River.

1103. Wyoming State Engineer. 1970. Water and related land resources of the Green River Basin, Wyoming. State Engineers Office, Cheyenne, Wyo., Water Planning Program Rep. 3. 175 pp.

MANAGEMENT, RESOURCES, RIVER-Green, WATER QUANTITY

Discusses water and related land resources in the Green River Basin in Wyoming and provides an evaluation of the water needs and resources of the Basin relative to the overall water needs and resources of Wyoming. Present water uses are inventoried and alternative water development plans are presented.

1104. Wyoming State Engineer. 1973. The Wyoming framework water plan: a summary. Wyoming State Engineer, Water Planning Office, Cheyenne. 24 pp.

PLAN, WATER QUANTITY

Summary of the water plan for the State of Wyoming, including the important Colorado River system.

1105. Yingst, P. O., and E. J. Mayhew. 1967. Mineral leases on public lands. Colorado School of Mines, Golden, Miner. Ind. Bull. 10(2): 1-12.

LAW, MINERAL, POLICY

Summarizes the provisions of the General Mineral Law of 1872 and Mineral Leasing Act of 1920 by individual classes of mineral on public lands in Colorado.

1106. Young, A. A., and H. F. Blaney. 1942. Use of water by native vegetation. California Dep. Public Works, Div. Water Resour., Sacramento. 160 pp.

VEGETATION, WATER QUANTITY

Reviews the water use by native vegetation in California. This information can be applied to the Upper Colorado River Basin, since many of the plants are also found there.

1107. Young, R. A., and S. L. Gray. 1972. Economic value of water: concepts and empirical estimates. U. S. Natl. Water Comm., Washington, D. C., Rep. NWC-SBS-92-047. 350 pp.

ECONOMICS, WATER RESOURCE

Estimates the value of water and discusses the concepts of applying a value to water that is applicable anywhere.

1108. Young, R. O., W. T. Franklin, and K. C. Nobe. 1973. Assessing economic effects of salinity on irrigated agriculture in the Colorado River Basin: agronomic and economic considerations. Dep. Econ. and Agron., Colorado State Univ., Fort Collins, Report to U. S. Bur. Reclam., Denver, Colo. 219 pp.

AGRICULTURE, ECONOMICS, IRRIGATION, RIVER-Colorado, SALINITY

Considers the economics of irrigated agriculture as affected by salinity in the Colorado River.

1109. Zwinger, A. 1975. Run, river, run: a naturalist's journey down one of the great rivers of the West. Harper and Row, New York. 330 pp.

ARCHAEOLOGY, BIBLIOGRAPHY, DESCRIPTION, GEOLOGY, HISTORY, RIVER-Green, VEGETATION, WILDLIFE

A naturalist's commentary on the Green River from its source in the Wind River Mountains of Wyoming to its confluence with the Colorado River. Described in 15 segments, with illustrations and maps emphasizing vegetation, geology, and archaeology. Narrative includes history and wildlife.

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As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

March 3 1849

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
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